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This bimonthly bulletin reports the current literature in science and public policy. Science is used to denote engineering, technology, and other sciences. The bulletin is intended for persons engaged in studying, formulating, or implementing policy relating to science and its use. Its purpose is to aid such individuals by alerting them to new additions to the science policy literature. The information presented consists principally of an annotated bibliographic listing of current publications in the area. Publications of a highly technical and narrowly specialized nature are excluded. The bibliographic information is presented under a number of topical categories which are (1) general, (2) science, domestic problems and national goals, (3) needs and allocation of resources for science, (4) national R and D programs, (5) science, education, and the university, (6) science management and policy making bodies, (7) science, foreign affairs and national defense, and (8) science policy in foreign countries. Each cited publication is recorded only under a single category. The numbering of publications under each category runs consecutively through all issues of the bulletin so that a given number refers to only one citation. Major meetings and other events in the subject area are also reported. (RS)

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Science Policy Bulletin

Battelle Memorial Institute

SE 007 150

SCIENCE POLICY BULLETIN

The Bulletin, published bimonthly, reports the current literature in the area of science and public policy. The coverage encompasses both "policy for science" and "science for policy" matters. For brevity, "science" is used to denote engineering, technology, and science.

The Bulletin is intended for individuals engaged in studying, formulating, or implementing public policy relating to science and its use. The purpose of the Bulletin is to aid such individuals by alerting them to new additions to the science policy literature.

The information presented in the Bulletin consists principally of a bibliographic listing of current publications in the area. In addition, major meetings and other events in the subject area are reported.

The bibliography, although covering a broad topical scope, is selective in that publications of a highly technical and narrowly specialized nature are excluded.

The bibliographic information is presented under a number of topical categories. Each cited publication is recorded under a single category; cross indexing is not used. The numbering of publications under each category runs consecutively through all issues of the Bulletin, so that a given number refers to only one citation.

Copies of the listed publications are not available through Battelle but can normally be obtained from the originating agency.

The contribution of information to the Bulletin as well as suggestions and comments on its content, coverage, and format are solicited. All correspondence should be addressed to:

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TRENDS IN SCIENCE POLICY SEMINAR

A seminar entitled "Trends in Science Policy" was held at the Battelle Seattle Research Center on 27 March 1969. Approximately 100 people, representing the government, industry, and universities were in attendance. Papers and topics discussed at the seminar were:

- "Science Policy and the New Administration"
[William J. Harris, Jr.]
- "R&D and National Goals and Priorities"
[Leonard L. Lederman]
- "Manpower Trends and Science Policy"
[Dael Wolfle]
- "Science, Politics and Priorities"
[Brewster C. Denny]
- Panel Discussion by an Ad Hoc Science Policy Group
[Eugene Skolnikoff, Raymond Bowers, Norman Kaplan, and Victor Rabinowitch].

Proceedings of the seminar are expected to be published in the near future.

BIBLIOGRAPHY

I GENERAL

14. Price, D.K., "Purists and Politicians", Science, v. 163, no. 3862, 3 January 1969, pp. 25-31.

Science and technology is "under attack simultaneously from two sides -- from a political reaction and from a new kind of rebellion". The basis and dimensions of this attack are discussed and a new strategy for science is proposed that "is more modest in its hopes for the perfectability of mankind and more pessimistically alert to the dangers of power". Price explores the relationship of science to politics with respect to knowledge, institutions, and policy, and their interrelations. He concludes that to "deal with any public issue of any consequence, we need to bring science and politics together in all their aspects. We need more precise knowledge. We need more effective institutions. And we need both the will and the competence required for the synthesis of general policy". "But there is a real danger ... that the two types of purists -- the scientist and the moralist -- will withdraw from public affairs and leave responsible political authority without support against the powerful combination of technological skill and special industrial and bureaucratic interests". The new strategy called for is one that starts by acknowledging "that reductionism in scientific knowledge, while it may provide the fundamental advances in scientific theory, does not alone provide the answers in the realm of policy, or the basis for a political ideology". The strategy and role for science in politics is "to help clarify our public values, define our policy options, and assist responsible political leaders" in applying science and technology in the public interest.

15. Kash, D.E., "Forces Affecting Science Policy", Bulletin of the Atomic Scientists, v. 25, no. 4, April 1969, pp. 10-15.

The social impact of R&D policy, the challenges and threats it has created, and the factors now at play in changing this policy, are reviewed and analyzed. The R&D contract, and its consequences, are discussed as a challenge to traditional political-economic concepts. Internal and first-order criteria, rather than social and second-order consequences, have

predominated in R&D decision making, which has produced a military-industrial complex, a new federal system that is extra-constitutional, and a fusion of functional sectors of the society. These, and other resultants of R&D face "this nation with a new kind of challenge and threat"; "the Congressional perception of this new condition is ... leading to the increased pressure for a change in the R&D system". "The clearest modification in R&D policy is the emergence of domestic economic and social progress as a prime motive for support". This "pressure for a change in R&D direction results from disenchantment with what is, rather than perceptions of new possibilities". Turning to the future, Kash argues that R&D is its prime determinant, that of the two revolutionary forces -- the poor and the New Left -- the latter is exerting more influence for R&D policy change, and that domestic goals are difficult to define in the absence of ideology. All these forces are coalescing to produce a different kind of R&D in which the focus is on "applied interdisciplinary research using systems analysis concerned with domestic problems".

16. Fitzpatrick, J., "A Crisis Facing American Science", Technology Review, v. 71, no. 5, March 1969, pp. 8-11.

The New York Academy of Sciences recently released "The Crisis Facing American Science", a report that assesses the effect of the impending \$6 billion federal budget cut on scientific research. The report, which was based on a survey of major universities and research centers, was sent to the Administration and Congress. Major findings and conclusions of the study are as follows: (1) American scientists and universities, heavily dependent on federal funding of research, must reduce their programs; (2) most inconvenienced by cutbacks are those persons, programs, and institutions that are not well established; (3) cutbacks are leading to the disbanding of fruitful research and to under-utilization of facilities and manpower; (4) research in crucial problem areas such as poverty and pollution is being neglected because of lack of support; (5) the future supply of scientific manpower is threatened; and (6) morale of scientists is low because of all these factors. The Committee proposed that the federal government find short-term sources of funds to alleviate problems in the training of manpower, support of "meritorious projects", and funding of innovative programs. Other recommendations made include a 15 percent annual growth rate for federal spending on research, improvement of methods of consultation and communication between the federal government and scientists, and "long-term multi-year" budgeting of federal research. The report also raises a variety of other policy questions which are to be studied by the Academy in the future.

17. Carey, W.D., "Toward the Proper Study of Man", Technology Review, v. 71, no. 5, March 1969, pp. 10-11.

The current problems and choices confronting science and technology are reviewed with the conclusion that a new "source of decisions" is needed to shape their goals and strategies so that science and technology are more relevant and responsive to society's needs. The author, who is a former assistant director of the Budget Bureau, comments on the leveling off of R&D funding (expected to continue) and cites some "tough policy choices" now facing the government (e.g., more scientists and high-grade institutions?, policy toward financing civilian technology?, strategy for the space program?). The support of R&D itself, says Carey, should be decided on the basis of its social return. The present R&D decision-making apparatus -- which is pluralistic and lacks a prime mover -- needs to be replaced by a system that is "responsive to standards of balance, purpose" and "priorities". "What I visualize is a center for examining the interaction of science with higher education, social change, international cooperation, technological development, and economic growth. It would be a center to examine the mix of national investment in science and technology, to assess the quality and social returns of the investment, to identify opportunities and imbalances, to formulate models for investment that are addressed rationally to the variety of needs that we face -- in short to make a start toward indicative planning of the uses of science and technology".

18. "Reorganization of Federal Science Needed", Chemical & Engineering News, v. 47, no. 8, 24 February 1969, pp. 40-41.

In a recent address on science and technology, Rep. E.Q. Daddario discussed several proposals for reorganizing the federal science structure, the "basic convictions" that underlie federal science policy, and the financial problems confronting R&D. He believes that some "administrative reorganization of federal science activities is probably needed if the nation is to meet its social responsibilities and at the same time maintain research activities at an effective level. But appointment of a 'single science czar' or creation of a 'super-bureau for science' would not be a desirable way to solve science problems". Federal science, says Daddario, is based on "these three basic convictions": (1) "The continuing development of science and technology at an optimum rate is vital to the national welfare". (2) "The Government should support science and technology wherever and whenever feasible". (3) "Control of federal support for science and technology should not be centralized". As for the financial problems, Daddario

attributes these to the shrinking size of the 'controllable' portion of the budget from which R&D comes, and to the competition from the "snowballing commitments to military and social welfare programs", rather than to "public disfavor" for science and technology.

19. Chapman, R.L., "Congress and Science Policy: The Organizational Dilemma", Bulletin of the Atomic Scientists, v. 25, no. 3, March 1969, pp. 4-7, 28.

Congress, after a decade of effort, is still unable to cope with the national policy issues concerning science and technology. Efforts in this direction are reviewed, obstacles to the development of an integrated national science policy are discussed, and some recent proposals for more adequately dealing with the problems are cited. Effective congressional action is hampered by the difficulty of viewing "the broad sweep and impact" of federal R&D while concurrently "evaluating research within the context of the agency mission toward which it contributes", and by the lack of analysis and measures of "the impact of science and technology within our economy". Contributing to the problem is the plethora of committees with jurisdictional interests in science and technology, which prevent national programs (involving different agencies) from being viewed as a whole. The obstacles to a more integrated congressional review of U.S. science policy are attributed to the failure of the executive branch "to develop anything resembling a 'science policy' itself", and "the reluctance of Congress to vest central authority for science and technology in a single committee". Several recent congressional proposals (e.g., creation of a technology assessment board) are mentioned as possible mechanisms for providing the broad view, but the author believes that "we are most unlikely to see anything approaching a ... consolidated approach toward science and technology in the Congress until the executive branch takes the initiative to provide some general science policy framework".

20. Reagan, M.D., Science and the Federal Patron, Oxford University Press, New York, 1969, 346 pp., (\$6.50).

Government patronage of R&D is discussed and guidelines to future policy requirements and legislation are presented. The author explores in detail the growing problems in science policy originating in the mutual dependence of science and government, especially with regard to integrating the needs of both. The main justification of R&D "is in its promise of utility". Government is not in the business of "patronizing culture": it supports R&D in the hope of obtaining a "payoff". While the cultural argument is not meaningless, it does "not justify the level of support that has developed". Basic points to be considered in

elaborating a formal science policy should include (1) improvement of "the representational structure of science and technology", partly by a high level of technical advice and partly by more equitable representation of all segments of the scientific community; (2) "a careful statement of the total government position vis-à-vis science and technology"; and (3) a planning system to "tie together science resources development and science utilization more explicitly and more effectively". The need for coordination "to integrate and stimulate ... science and technology and for the development of an overall federal science policy" should be, in the author's opinion, at the Presidential rather than the departmental level.

21. Peters, L., "An Interview With Philip Handler", News Report, v. 19, no. 3, March 1969, pp. 5-11.

The President of the National Academy of Sciences discussed some of his views on issues concerning the Academy, science, education and national policy. In regard to the Academy and its opportunities for growing in new directions, Handler feels "we shall have to find ways to make the limited understanding of the social sciences as useful as possible" in the serious problems of society. In respect to the crisis in science, Handler does not feel that the VietNam war is the only cause of the decrease in funding: "the expenditures for science had grown to a very significant portion of the manageable piece of the Federal budget, so that the sharp rate of growth was due to decline in any case. The VietNam war exacerbated that process". In regard to education, Handler gave his views on what new mechanisms ought to be created in addition to the project grant system for funding graduate research in science. He discussed the recent National Science Board report, "Toward a National Policy for Graduate Education in the Sciences", which describes several ways to get at this problem. In respect to national policy, Handler states that there should be no constraints placed on fundamental research even if there is some reason to believe that the results of that research might be harmful: "Utilization of scientific information is a political and social decision and we have mechanisms in our society for arriving at such decisions".

22. Quinn, J.B., "National Strategy in Science and Technology", Science Journal, v. 5, no. 4, April 1969, pp. 77-81.

"How can nations best utilize science, technology and innovation to enhance human well being?" These three forces, says the author, are the prime means for national development. And of these, the major ingredients "are not science

and invention but technology, innovation and the diffusion of proved technologies throughout the society". The four traditional factors of economic growth (land, labour, capital, and education) have technology as "the vital growth component of each", and a technological innovation may have multiplier effects far more significant to a society than the multiplier created by the initial investment. It is suggested that a nation desiring balanced and continuous growth "must orient its strategies for more around technology, and less around investment per se". The best ways for nations to acquire the technology they need is discussed, as well as the means for choosing among alternatives and for formulating a national strategy. The problem of selecting national goals is regarded as the most difficult single problem; this is discussed, along with the question of high vs. low technologies for developing nations and the role of scale of industry and market in national planning. Finally, the author, calls for the "next major focus of science policy" to be "on legislative decision processes. Without substantial improvements, archaic legislative methods will thwart the effective development of science and technology to improve the well-being of all humanity".

23. Golovin, N.E., "The 'Evaluative Function' in Government", PB 180 359, 25 October 1968, 46 pp.

A fourth branch of government -- the evaluative branch -- is proposed as a mechanism for coping with complex, long-range socio-economic problems. The paper begins with "a brief description of some social problems whose systematic analysis and treatment ... are inhibited by the absence of suitable fact-gathering and analytical machinery. It then proceeds to a discussion of the several reasons why such machinery is not now available, and of some of the alternative ways in which it might be feasible to provide it. The concept of an 'evaluative branch' of government is then explained and some of its potential advantages outlined". The new organizational mechanisms, applicable to all levels of government, would (a) collect and analyze information, (b) define potential problems and needs, (c) develop alternative plans for government and public consideration, (d) evaluate the results of established programs, and (e) keep the nation informed of the nature and results of its work. The "fourth branch" would be established by constitutional amendment; its activities would be "non-executive, non-legislative and non-judicial". Instead, "its concern would be primarily with the longer-range, inter-branch, inter-agency, inter-disciplinary issues which the existing organizational structure finds it difficult to fact, to understand, and to resolve".

(This report may be obtained from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Va. 22151, Price \$3.00).

24. Price, D.J. de.S., "Measuring the Size of Science", Yale University, 11 February 1969, 21 pp. (plus tables and figures).

This "science of science" report presents data on scientific activity, in terms of technical papers and authorship, for some 100 nations and relates it to such factors as GNP, per capita wealth, and the number of scientists. Starting first with a discussion of the rationale for publication counting as a measure of scientific output, the author reviews some earlier findings obtained with this method and presents some new data, and associated analyses, regarding the "proportion of total science" done by each nation, the major "scientific cities", and the distribution of "publishing scientists" within nations. The results of the study show that "90 per cent of the world's science resides in the top 14 nations, and that 40 nations in all account for all but 1 per cent of the world's contribution"; for the small countries as well as the large, their share of the world's wealth correlates highly with their share of the world's science (for example, "Canada and India each possesses about 2 per cent of the world's GNP and a similar amount of its science, even though the population of India is 25 times that of Canada"); nations distribute their scientists among cities in very different patterns (e.g., the US is highly decentralized, while the USSR's scientists concentrate in a few cities).

(This report may be obtained from Prof. Derek J. de Solla Price, Department of History of Science and Medicine, Yale University, New Haven, Connecticut 06520).

25. Grossfield, K., "National Interest Aspects of Innovation", Advancement of Science, v. 25, no. 125, March 1969, pp. 335-343.

The impact of technological innovation, in terms of national gain, is discussed and policies for encouraging and exploiting such innovations are suggested. A technique for measuring the national gain from an innovation is outlined and illustrated by an actual case (a new potato harvester). This technique and economic data "are used to show that the rewards to the innovators are often small in relation to the gains to the nation", that the need for Government support for innovation in industrial equipment is particularly great, and that assistance to pioneer purchasers of such equipment may prove most valuable. "Against this background the principal existing schemes to assist first purchasers are outlined and an additional proposal is put forward". By way of conclusion, the author argues that "increasing utilization of technologically advanced equipment is essential to the national interest",

that pioneer purchasers of such equipment "are subject to additional risks and costs without corresponding rewards", and that inducements for such purchasers "would yield a disproportionately large gain to the nation".

26. "Program of Policy Studies in Science and Technology", N69-15015, The George Washington University, Washington, D.C., 1968, 90 pp.

An overview is presented of the program's continuing and prospective activities in policy research concerned with the science-society interface. The program -- initiated in 1966 and funded by the University, government, and industry -- focuses on the study of "the structure and functions of institutions designed to stimulate, utilize, regulate, and appraise the application of science and technology to the achievement of basic community goals". "The most concentrated effort of the Program ... has been in the area of technology assessment: the identification of the effects ... and the evaluation of the social desirability or undesirability of such effects as related to particular technological applications". Other areas of interest include "technological innovation" (the innovation, transfer, and use of technology in the civilian economy), "institutional response" to science and technology, and the application of R&D management techniques to "the planning, programming, and managing of social programs". An appendix to the report presents abstracts of studies and papers generated under the program.

(This report may be obtained from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Va. 22151, Price \$3.00).

II SCIENCE, DOMESTIC PROBLEMS, AND NATIONAL GOALS

9. Lederman, L.L. and Windus, M.L., "The Allocation of Federal Budget Resources as an Indicator of National Goals and Priorities", Parts I (N69-20989) and II (N69-20988), Battelle Memorial Institute, Columbus Laboratories, 10 February 1969.

This report is an analysis of trends in the allocation of R&D resources and their relationship to national goals and priorities. Federal expenditures from 1961 to 1969 are analyzed for 13 functional areas, such as welfare, health, education and knowledge, and national security. These areas are viewed as national goals and the resources allocated to them as an indicator of priorities. The analysis shows that "relative priorities among national goals ... have not changed sharply" and that "breaks with past trends occur only rarely". Another finding is that the allocation of R&D resources to the goal areas differs greatly from the allocation of total federal resources to these areas; but the trend is toward a closer correspondence between the two. Looking to the future, the authors expect few changes from past trends, except for "General Government" (because of the "law and order" concern) and education, both of which are expected to receive a larger proportion of total federal funds. Above average growth, in both total and R&D expenditures, is expected to continue in the areas of health, welfare, agriculture, housing and community development, and labor and manpower; and below average growth in total expenditures is expected to continue for international relations, veterans, space, national security, natural resources, commerce, and transportation and communication.

(This report can be obtained from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Va. 22151, Price \$3.00 for each part of the report).

10. "Toward a Social Report", U.S. Department of Health, Education, and Welfare, Washington, D.C., 1969, 101 pp.

"This document represents a preliminary step toward the evolution of a regular system of social reporting". It is the outgrowth of meetings of social scientists and government representatives who were invited by HEW to offer suggestions for a program designed to evaluate national wellbeing by developing measures of social change. The panel pinpointed these areas as most indicative of the Nation's social health and thus most in need of such measurement: health and illness; social mobility; physical environment (pollution,

housing); income and poverty; public order and safety; learning, science, and art; and participation in and alienation from social and political institutions. Measurements of changes in these areas could improve public policymaking by serving as the bases for evaluations of on-going public programs and by contributing to the formulation of program priorities that would bring us closer to our national goals. This first report surveys the current statistics we have available and points to gaps that must be filled by a new system of data collection specifically designed to assess the quality of our culture for policy purposes. Some specific "social indicators" discussed were: the expectancy of healthy life free of bed-disability and institutionalization, the expectancy of being victimized by a criminal, and occupational mobility across generations. Broad suggestions for the construction of other social indicators are presented.

(This report may be obtained from the U.S. Government Printing Office, Washington, D.C. 20402, Price \$.55).

11. Carroll, J.D., "Science and the City: The Question of Authority", Science, v. 163, no. 3870, 28 February 1969, pp. 902-911.

The movement in the federal government to design and undertake a comprehensive set of urban R&D activities is described and analyzed. The movement is interpreted "as the beginning of a belated national effort to relate legal and administrative structures and processes to processes of scientific inquiry and social and technological change for purposes of urban development". The problems facing the city are discussed, and the policies and content of the Department of Housing and Urban Development's (HUD) R&D plans and programs to meet these problems are described in considerable detail. The prospects and problems of HUD's R&D efforts are discussed and obstacles to achieving their objectives are analyzed. It is concluded that it "may be some time before this effort produces substantial results". The success "will depend on significant changes in social and political attitudes and organizations, on significant changes in federal research and development policies ... and on ... changes in ... attitudes concerning the nature and purposes of science and technology". If the movement is successful, it "should add a new dimension to public science and technology and strengthen the case for public support of research and development in the future".

12. Haire, M., "Industrial Technology and Urban Affairs", Technology Review, v. 71, no. 4, February 1969, pp. 23-27.

Some of the difficulties of bringing technology to bear on urban problems are described and possible solutions to the

difficulties are proposed. "Technologies pertinent to major urban problems are available well beyond our current utilization of them". "What kind of things account for this strange anomaly -- on the one hand a pressing national need, and, on the other, high levels of relevant technology, but a failure of the two to come together?" The anomaly, it is suggested, arises from several factors: a pluralism of customers and suppliers with neither knowing the other; failure "to state the cities' goals and needs in such a way that technological possibilities can be made relevant to them"; "the differences in organization, climate, and tradition between cities and industry; a shortage of money, from federal and local sources, and ineffective use of it. As a first step toward solving these problems, the author calls for an R&D agenda that sets down what needs to be done and the possibilities for doing them, and which sets priorities and explores new possibilities. To do this, a quasi-public organization -- an Urban Technology Development Corporation -- is needed. The roles of universities in such an undertaking are discussed.

13. Etzioni, A., "Agency for Technological Development for Domestic Programs", Science, v. 164, no. 3875, 4 April 1969, pp. 43-50.

An agency devoted to the development and application of technology to urban problems is proposed. The suggested "Agency for Technological Development" (ATD) would consist of certain parts of Housing and Urban Development (esp. the Model-Cities Administration), "augmented by the transfer of several 'technological' units from other agencies". The need of and possibilities for technological shortcuts to ameliorating urban problems are illustrated and discussed. The existing organization of domestic R&D is reviewed, from which it is concluded that the technological division in many agencies "is an administrative stepchild"; the budgets of these divisions is only a small fraction of the parent agency's budget; and there is waste of resources and duplication of effort under the present system. Obstacles to the proposal (e.g., opposition from existing agencies, Congress, and industry) are cited and discussed and some possible ways around them are presented. As for financing, the author sees the possibility of local government funding ATD from federal funds supplied to state and city governments.

14. Walker, E.A., "A Call to Arms", Scientific Research, v. 4, no. 7, 31 March 1969, pp. 35-36.

The gulf between men of science and the rest of the population is discussed and a possible solution is presented. Unlike C.P. Snow, who, in his book, Two Cultures and the Scientific Revolution, blames the gulf on "lack of communication, Walker, who is

president of Pennsylvania State University and the National Academy of Engineering, suggests that the gulf results from wrong priorities and goals set by scientists. More visible and perhaps more important to the average citizen than the moon flights and sophisticated communication systems are these unsolved problems: slow ground transportation; pollution of air, land, and water; primitive sewage treatment; and overcrowded and deteriorating environments. The author counsels that "perhaps we must mobilize all of the country's resources -- government, industry, the public pure scientists, applied scientists, engineers and businessmen -- to solve these national problems". He believes that such a "war", even if limited to only four years, would bring phenomenal advances and would "insure domestic tranquility" and "promote the general welfare".

15. "'Seefuss': A Big, Big Job to Do", Scientific Research, v. 4, no. 5, 3 March 1969, pp. 22-24.

According to its administrator, Charles C. Johnson, the Consumer Protection and Environmental Health Service (CPEHS) is "the lead agency in the federal establishment to insure that our growing knowledge of ecology and technology is vigorously applied to man's environment and the products he consumes". The agency's primary concern is "to give first priority to the development of broad environmental criteria", as well as to "become the spokesman, not just for conservation or pollution abatement or food or drug protection or sanitation but for man -- the citizen and consumer". The research program of CPEHS (budgeted for \$107 million in FY '70), is to focus on the relationship of "man and his environment as a total system for which standards can be developed". The program is under review by a R&D steering committee which will undertake three major tasks: "Review the entire CPEHS research system ... for relevance -- and then set priorities"; "examine existing environmental surveillance systems ... to see if they need to be modified or supplemented"; "establish a national environmental health center". Other areas which CPEHS is expected to give research priority to include air and water pollution, rodent control, noise control, and solid-waste management.

16. "President's Council on Environmental Policy", Science, v. 164, no. 3978, 25 April 1969, p. 410.

"A new environmental quality control council is being created by President Nixon to coordinate interagency action on environmental problems. At this time the eight-member council, chaired by the President, has been organized to include Vice President Agnew and the secretaries of six departments, including Interior and Health, Education, and Welfare. Lee A. DuBridge is slated to be executive secretary. The Council

is expected to establish an environmental policy on such issues as pollution, conservation, and resources".

17. "Science's Impact on Humans Concerns Muskie", Chemical & Engineering News, v. 47, no. 13, 24 March 1969, pp. 42-43.

The first round of hearings on legislation (S.R. 78) to establish a Senate Select Committee on Technology and the Human Environment received the support of all witnesses. The bill, introduced by Sen. Muskie, would create a "central forum to study the future impact of scientific and technological change, its benefits and hazards, on population, communities, and industries". The forum would be made up of three members from each of the present committees directly concerned with the individual and his environment. Dr. Harvey Brooks, speaking in favor of the basic aim of the bill, pointed out that, "choices between alternative technologies and their effects are essentially political choices ... they involve choices between competing and conflicting interests and scales of value and therefore, can only be resolved as part of the political process". The basic problem facing such a committee would be to establish realistic boundaries and reach "agreement on what the problem of 'technology and the human environment' really is", according to another witness, Dr. Herbert Simon, of Carnegie-Mellon University.

18. "Science Board to Study the Environment", Scientific Research, v. 4, no. 8, 14 April 1969, p. 19.

"With the ink barely dry on the first annual report of the National Science Board -- a two-volume proposal of public policy for graduate education in the sciences -- the Board is already planning its third report. (The second report, due to Congress January 15, 1970, will be on the physical sciences.) The third report, due a year later, will be a comprehensive study of, and forecast on, the environment. The first report was staff-written; the second will be the joint work of the Board's staff and an ad hoc committee; the third will be produced entirely by a large committee of environmental experts drawn from all over the nation. Committee co-chairmen are: Frederick E. Smith, chairman of the Department of Wildlife & Fisheries at the University of Michigan's School of Natural Resources; and Julian R. Goldsmith, associate dean at the University of Chicago in the division of physical sciences. The committee will have panels on such topics as air pollution, water pollution, solid wastes, and drug abuses".

19. "The Environment: Hill vs. White House", Chemical & Engineering News, v. 47, no. 18, 28 April 1969, pp. 16-17.

Differences of opinion over restructuring the federal government to deal with threats to the environment arose at a recent Senate Interior committee hearing on legislation proposing a national policy for the environment (S. 1075). The issue centered on "whether to deal with the increasing threats to the natural environment through an interagency council established by the President or through an independent advisory group set up by Congress". Senators who introduced the legislation strongly favored the independent group while the interagency council was supported by both Presidential science adviser DuBridge and Interior Secretary Hickel. Proposals for an interagency council based on the recently announced cabinet-level Environmental Quality Control Council were criticized by Senators Jackson and Nelson who expressed doubts about the amount of time each agency had available for broad policy issues and the continuous "conflicts of interest" normally occurring between agencies resulting in compromises and in "least common denominator" agreements on interagency problems.

20. "Shaping the Clean Water Act", Science News, v. 95, no. 9, 1 March 1969, p. 208.

New legislation, designed to correct loopholes in previous pollution control laws, is presented in Senator Muskie's Water Quality Improvement Act of 1969. The bill "attacks three major sources of water pollution not now covered by recent legislation: pollution from oil, vessels, and heat". "In addition, the bill emphasizes three new research areas: acid mine drainage, lake eutrophication, (oxygen depletion) and oil pollution removal". Significant provision of the proposed bill are those for penalties of \$5000 in cases of failure to notify the Secretary of Interior and up to \$15 million for failure to clean up oil pollution from any cause. Other features of the Muskie bill include (1) the establishment of standards for on-board sanitation devices on private commercial or pleasure craft; (2) provisions for certification of nuclear power plants by interstate or state agencies. This would also apply to fossil fuel power plants, dam construction and industries which use navigable waterways for any type of cooling.

21. "Federal Water Resources Research Program for Fiscal Year 1969", Federal Council for Science and Technology, Office of Science and Technology, Executive Office of the President, Publication No. 7, Washington, D.C., 1969, 48 pp.

"This is the fifth annual report of the Committee on Water Resources Research (COWRR) of the Federal Council for Science and Technology (FCST). Research expenditures of seven Federal departments and four independent agencies are presented for fiscal year 1967 and estimates of expenditures are shown for fiscal years 1968 and 1969. In addition, the report describes and summarizes the organizations and activities of COWRR which is charged with the task of assisting in coordinate water resources research across the entire structure of the Federal Government. Responsibility for coordination as designated by the President, rests with the President's Special Assistant for Science and Technology". "National (Federal, state, local, private) investment in water resources development is about \$14 billion annually. The estimated long-term investment in urban water supply and waste water (sewers and pollution control) facilities alone is over \$90 billion. Annual new investment will be increasing each year as urbanization spreads, as efforts to control water pollution grow and as water resource developments are authorized to provide increasing amounts of water to a growing Nation".

22. "Water Resources Policy: Research Required", Washington Science Trends, v. 22, no. 1, 14 April 1969, p. 1.

A White House consultants' panel report, Water Resources Policy and Political Institutions, was recently released. The report contends that the Federal Government has virtually ignored research required on the "relationship between the Nation's water resources and its political institutions". The group reported to the White House: "There appears to be little concerted effort directed toward analysis of the possible effect of a given policy on future water management needs. Nor does there appear to be any comprehensive effort to appraise the relative effectiveness of existing national policies". Additional funds and an intensive re-evaluation effort were recommended, with emphasis on problems such as: "Is the river basin a valid water management unit? Does 'multi-purpose planning' produce concurrent multi-purpose benefits? What key ingredients make 'trans-basin diversions' mutually advantageous? Have existing water rights doctrines limited or impaired needed water resources development? What type of grant programs are most effective and efficient? What are the effects of allocating financial responsibility? How have the policies of public institutions

affected private development or exploitation? Can basic principles be developed to guide the decision-making process?"

(For further details on proposed research programs, Water Resources Policy and Political Institutions, Report No. PB 182 930 will be available in the near future at \$3 from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Va. 22151).

23. "HEW Criticized for Air Pollution R&D", Science, v. 164, no. 3876, 11 April 1969, p. 167.

"A House Government Operations Committee report has charged that the Department of Health, Education, and Welfare (HEW) is lagging in developing new techniques to combat air pollution. The report, reviewed by the Conservation and Natural Resources Subcommittee, chaired by Representative Henry S. Reuss (D-Wis.), says that research and development on air pollution abatement, particularly on the reduction of sulfur oxide pollutants, has been largely ineffective and wasteful. The report was particularly critical of the lack of coordination in interdepartmental research efforts. 'Federal air pollution research and development: An interim report on sulfur oxides pollution abatement R&D' may be obtained at no cost from the Conservation and Natural Resources Subcommittee office, Room B-349-C, Rayburn Building, Washington, D.C."

24. Boffey, P.M., "Radioactive Pollution: Minnesota Finds AEC Standards Too Lax", Science, v. 163, no. 3871, 7 March 1969, pp. 1043-1044, 1046.

"In a move that could have national repercussions, the Minnesota Pollution Control Agency (MPCA) announced ... that it will limit radioactive discharges from nuclear reactors to levels considerably below those currently allowed by the Atomic Energy Commission (AEC)". The circumstances leading to this position are described, the recommended safety standards are compared with those of AEC, and the implications of MPCA's action is discussed. AEC's standards, usually "regarded as more or less sacrosanct", were challenged on the grounds that they did not take local circumstances into account and that the standards, per se, were deficient, in that they neglect multiple sources of radioactive pollution (which would arise when more reactors are built in the area), fail to consider potential harm to lower organisms, and do not allow a "reserve capacity in the environment in case of nuclear accidents". As for implications, the controversy raises again the question of conflict of interest: AEC is charged with promoting nuclear power as well as protecting the public. Also raised are

"legal questions as to whether the states can enforce more stringent rules than the AEC, or must simply accept the AEC's judgment as infallible".

III NEEDS AND ALLOCATION OF RESOURCES FOR SCIENCE

11. "1969 R&D Tab: \$27.175 Billion", Scientific Research, v. 4, no. 6, 17 March 1969, pp. 13,15.

The McGraw-Hill economics staff has estimated a 6.6 percent rise in U.S. R&D spending for 1969. Their estimates, based on industrial surveys and National Science Foundation studies, indicate a total expenditure of \$27.175 billion, as compared with an earlier estimate by Battelle Memorial Institute of \$25.9 billion. The significant projection estimates are as follows: Industrial R&D, \$19.4 billion compared with \$17.989 billion in 1968 (up 7.8 percent), with the government contributing 51 percent of the total; government laboratory R&D, \$3.56 billion compared with \$3.46 billion in 1968 (up 2.9 percent); university and nonprofit organization R&D, \$4.215 billion compared with \$4.04 billion in 1968 (up 4.3 percent). A separate manpower analysis showed that of U.S. scientists and engineers, mathematicians and life scientists had the highest numerical increases of 28 and 27.5 percent respectively. Physical scientists showed a growth rate of only 14.8 percent. "The total number of r&d scientists and engineers in the U.S. this year will reach 565,000 or 36.3 percent of all scientists and engineers ... a drop of about 1 percent from the total five years ago".

12. "Federal R&D Budget Cloud Might Have Silver Lining", Industrial Research, v. 11, no. 3, March 1969, pp. 29-30.

A long-range forecast of government support of R&D is presented. While former President Johnson's 1970 R&D budget called for \$400 billion over 1969 levels, "the key fact about this budget is that it does not commit the Nixon administration to any new programs". However, a "steady decline in R&D relative to the economic growth of the nation" is noted: in 1966 R&D was 2.2 percent of the \$720-billion GNP, the current year shows R&D to be less than 1.9 percent of the \$900-billion GNP. The reason given for this is that R&D is the "largest single item of controllable expense". The Department of Defense Budget (1971, \$81.5 billion) is "virtually sacrosanct" and is usually modified upwards. "[U]ncontrollable civilian outlays" (Social Security, interest on the national debt, veterans pensions, postal operations, farm price support, etc) accounts for \$98.8 billion of Johnson's \$195.3-billion 1971 Budget, leaving "less than \$20 billion (which includes civilian R&D) from which Congress can cut". Despite cuts yet to be made, research spending

will rise faster than new obligations, military development obligations will be up, and the National Science Foundation should return to its \$500-million level. Increases for NSF should permit increased support for institutional grants, the National Sea Grant Program, the International Biological Program, and support new interdisciplinary research on social problems.

13. "President Nixon Slashes \$240 Million from Johnson's \$17.1 Billion R&D Request", Chemical & Engineering News, v. 47, no. 18, 28 April 1969, p. 31.

If Congress approves President Nixon's \$240 million reduction in R&D funds, the areas to sustain the greatest cuts would be the Department of Defense (down \$70 million), the National Institutes of Health (down \$52 million), and the National Aeronautics and Space Administration (down \$45 million). The Atomic Energy Commission suffered the largest overall agency cut; \$78.6 million was cut from the 1970 request of \$2.4 billion, and resulted in elimination of the "once-promising food irradiation program". The biology and medicine program and isotopes development sustained a cut of \$700.00. The NIH reductions "would affect general research support grants, grants for general clinical research, and grants for environmental health science institutes", each of which "would be held to the 1969 level". Other departments to have science funding cuts include the Commerce department and the National Bureau of Standards. The National Science Foundation would get \$497 million, up from the drastic cut of 1968.

14. "NSF's Varsity Try Unlikely to Save Budget", Scientific Research, v. 4, no. 8, 14 April 1969, pp. 13-14.

After nine days of authorization hearings, the National Science Foundation 1970 Budget is still in doubt. Congressmen were skeptical about the new \$10-million interdisciplinary social science program, and considered it to have such "tenuous goals" that support would not be forthcoming. NSF's picking up DOD research projects that had been dropped was also questioned. The NSF officials maintained that "They add to the nation's scientific capability". Representative Daddario, Chairman of the House science, research and development subcommittee, said that "(i)f the NSF took over the DOD's projects ... the Foundation's work might 'lift our intelligence capability but not go toward solving our domestic problems'". "Daddario's concern is primarily that, given the limited nature of its funds, the NSF maintain the flexibility to decide what to support". It is believed that Daddario will not recommend cutting for the sake of cutting, but that he has doubts about some areas of the NSF budget. The NSF is

to answer in the near future the questions raised by Daddario and the subcommittee; otherwise it is expected that the programs will be eliminated or transferred to other agencies.

15. Walsh, J., "NIH: Another Right Budget, Fewer Friends in High Places", Science, v. 164, no. 3876, 11 April 1969, pp. 165-167.

Problems plaguing NIH and recent organizational changes and their implications for that agency are discussed. The problems facing NIH are varied: (1) a tight budget may spell the end of some programs; (2) "public demand for federal spending on health services" and the financial demands of Medicare and related programs may bring about a decrease in biomedical research; (3) opposition from the AMA to the appointment of John Knowles as assistant secretary of health and scientific affairs has left "medical research without a strong advocate in HEW"; and (4) NIH has untried top leadership in the person of Robert Q. Marston who must face the problems of "a reorganized agency with expanded responsibilities". "Organizationally, NIH and its sibling agencies are settling into the remodeled structure of the health component of HEW". A new policy advisory committee has been established at NIH and other changes related to a new administration are discussed.

16. Normyle, W.J., "Space Fund Boost Hits White House Snag", Aviation Week & Space Technology, v. 90, no. 15, 14 April 1969, pp. 27-28.

The Nixon Administration is responding to requests by the National Aeronautics and Space Administration (NASA) for \$200 million in supplemental R&D funds "by emphatically ordering future reductions" in the 1970 budget. NASA Administrator Thomas O. Paine requested the funds in addition to the proposed 1970 NASA budget of \$3 billion in "new obligational authority" as necessary to maintain minimum R&D. The Bureau of the Budget told Paine "that he should plan to take a loss of \$140 million", despite conclusions by three key subcommittees (manned space flight, advanced research and technology, and space science and applications) that NASA's R&D should be increased by \$234.4 million. Until decisions are made by Nixon on the future U.S. space goals, the cut would "wipe out" work on space stations, shuttle/logistics vehicles, and manned lunar exploration. Feasible future programs are presently being studied by a special ad hoc committee, which includes Vice President Spiro Agnew, Presidential Science Adviser Dr. Lee DuBridge, and NASA's Thomas Paine. Military space goals are being evaluated in the study, which will be reported in September.

IV NATIONAL R&D PROGRAMS

12. Baird, J., et al, "Some Major Impacts of the National Space Program -- Final Report of Pilot Study", N69 12564, Stanford Research Institute, September 1968, 48 pp.

This study is "oriented toward the resolution of the problem of definability and measurability of some impacts of the national space program, while simultaneously pursuing the goal of establishing some of these impacts -- both positive and negative". Six areas were selected for study: new occupations created by the space program, impacts upon aviation and aeronautics, astronomy as an example of scientific impacts, impacts of new materials technology, economic impacts, and medical, biological and public health impacts. Separate reports were prepared for each of these areas; the present report summarizes the results from the overall study. "Some of these topics tended to yield pertinent and quantitative information immediately, while other topics could not be reduced to simple conclusions". Illustrative findings include the following: few new occupations were found but it was concluded that many existed although not specifically identified; the aviation and aeronautics effort "has been eminently successful"; and in the materials area, only a few civilian applications were found, but this is attributed to the 10 to 25 years that elapses between invention and the appearance of the product on the market.

(This report may be obtained from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Va. 22151, Price \$3.00).

13. "Astronautics and Aeronautics, 1967", Chronology on Science, Technology, and Policy, NASA SP-4008, National Aeronautics and Space Administration Historical Staff, Office of Policy, Washington, D.C., 1968, 487 pp.

"This useful chronology on Astronautics and Aeronautics, following the pattern of its predecessor volumes, offers first documentation upon the multitudinous events, people, and circumstances of the last year of the first decade of the Space Age". This history of space-related events for 1967 provides a review of space, flights, policy statements, press conferences and newspaper articles, as well as summaries of the scientific results of each launch during the year. In addition to the monthly entries, three appendices are included: "Satellites, Space Probes and Manned Space Flights, 1967"; "Major NASA Launches, 1967"; and "Abbreviations of References". Additional aids included are an

"Index and List of Abbreviations and Acronyms" and a list of NASA historical publications.

(This report may be obtained from the U.S. Government Printing Office, Washington, D.C. 20402, Price \$2.25).

14. Mandelbaum, L., "Apollo: How the United States Decided to Go to the Moon", Science, v. 163, no. 3868, 14 February 1969, pp. 649-653.

The history of the approval of the Apollo decision is examined for its "contribution to a better understanding of our national decision-making processes in the field of research and development". The events and decisions during 1958-61 that led to the Apollo project are retold, and the involvement of the executive branch, congress, and the scientific community in the decision is described. In their totality, says the author, the factors involved produced a "technological impulse" to go to the moon. This decision, because of the resources it demanded, necessarily involved questions of priority, which "are primarily political questions to be decided upon by political and administrative representatives with the full and knowledgeable participation of the entire concerned community". While it might be difficult to expect a "mature policy" at the onset of a sudden technological expansion, such as that signalled by Sputnik 1, more than a decade has passed, and evidence provided by recent decisions indicates that unless there is an integrated policy and "decision-making machine", "technological impulse ... will prevail". Resources should be channeled to projects fulfilling "basic social objectives", ahead of "prestigious or otherwise marginal projects"; that is, a well-integrated policy would ensure that "limited resources will be employed at a maximum advantage". At present, the "fragmented framework" of federal R&D decision-making has not essentially changed since 1961.

15. Normyle, W.J., "Nixon to Back Manned Lunar Plan", Aviation Week & Space Technology, v. 90, no. 16, 21 April 1969, pp. 16-17.

President Nixon's amendments to the proposed 1970 space budget will support post-Apollo manned flight at the expense of unmanned planetary space flight. The \$131 million cut was split as follows: \$57 million cut in the Apollo Applications program, \$41 million cut from the Office of Space Science and Applications (OSSA) unmanned flight programs, \$13 million off advanced research and technology projects, and \$20 million from tracking and data acquisition. \$86 million "in new obligational authority" was approved by President Nixon: "\$46 million to resume production of Saturn 5 beyond those required for Apollo 12 (manned lunar landing), and \$40 million for modifications to the lunar command, and service modules for extended exploration periods and "improvements in manned life-support systems". "NASA in effect has received almost all it

wanted for planning post-Apollo manned lunar exploration". Some argument is expected "within the full House Committee on Science and Astronautics over the Nixon Administration's decision to support manned space flight at the expense of unmanned planetary exploration".

16. "Earth Resources Satellite System", Report for the Subcommittee on NASA Oversight of the Committee on Science and Astronautics, U.S. House of Representatives, Ninetieth Congress, Second Session, (December 1968), U.S. Government Printing Office, Washington, D.C., 1969, 28 pp.

This report summarizes the findings and conclusions of the Subcommittee on Space Science and Applications concerning the Earth Resources Technology Satellite project. The existing base of space technology is summarized, the potential scientific users of satellite data are described and the history of the Earth Resources Satellite program is presented. The report emphasizes that "an earth resources satellite [ERS] system unquestionably presents NASA with an excellent opportunity; perhaps the best possible opportunity, to achieve tangible economic returns from the substantial investment already made by the American taxpayer in the U.S. space program". The Subcommittee recommends that NASA concentrate a much larger portion of its efforts and resources on this project", that reliance on "cost-benefit analyses alone should not be a crucial consideration during the research and development phase", and that an ERS system should be planned to "utilize automated spacecraft rather than continue as part of the manned space flight effort".

(This report may be obtained from the U.S. Government Printing Office, Washington, D.C. 20402).

17. "Study Urges Vigorous Effort to Apply Uses of Satellites", News Report, v. 19, no. 3, March 1969, pp. 1-2.

The report of a two-year study by the National Research Council has concluded that "the potential of practical benefits to mankind from unmanned earth satellites is substantial enough to merit a doubling or tripling of Federal support". The study group recommends "an extensive, coherent, and selective program" of satellite applications costing \$200 to \$300 million a year. Applications in two broad fields are imminent. The first includes communications, navigation and traffic control. In this category, high priority is recommended for the development of three programs: A multi-channel distribution system for public and private network television broadcasts; A multi-channel system for educational broadcast use in developing countries and for programming to special interest groups such as physicians, lawyers, engineers, and educators; A North Atlantic satellite navigation system for enroute traffic control of

transoceanic aircraft and ships. "The second broad category of imminent use is earth-sensing, in which instruments aboard satellites report on thermal radiation from land, sea, clouds, and atmosphere ... recording the information ... relaying it back to earth". "One major conclusion was that organizational problems ... will have to be solved before the full potential can be realized for the many projects".

18. Carter, L.J., "Lunar Science Institute: Link Between NASA and Academe", Science, v. 163, no. 3873, 21 March 1969, pp. 1311-1313.

A Lunar Science Institute (LSI) funded by NASA and set up by the National Academy of Sciences, is being established as a base for academic scientists to participate more directly in the space program. "LSI hopes to receive about \$1 million annually from NASA once it is in full operation"; its first major activity will occur in August 1969 when a month-long symposium will be held on the geophysical interpretation of the moon. Eventually, the Institute expects to have six or so staff members appointed for 1 to 2 year periods; visiting scientists for shorter periods of time will be provided travel funds and stipends. The Institute -- located in Houston, Texas -- is viewed as an addition to the scientific strength of the Manned Spacecraft Center and as a possible space science constituency in the academic community. LSI is expected to exert some influence on the long-term strategy of lunar exploration and on questions of priorities and mission planning. However, the "question of whether LSI emerges as a leading center for lunar and planetary studies is inseparable from the larger question of whether President Nixon and Congress will favor an ambitious post-Apollo program on lunar exploration".

19. "NAS Creates Universities Space Sciences Group to Oversee Lunar Institute and Plan Consortium", News Report, v. 19, no. 2, February 1969, p. 2.

The National Academy of Sciences has recently selected a twelve-member committee to serve as a board of governors for NASA's Lunar Science Institute. Members of the committee were selected to represent 35 universities "interested in forming a consortium to facilitate the participation of academic scientists in space research". The committee "will establish policy, review operations and budgets, and help advise the director of the Institute". In addition, the committee will draft objectives and procedures for the consortium to assume responsibility for the Institute in the near future. In this capacity, the "consortium would acquire, plan, construct, operate, and formulate policies for laboratories and other facilities for research, development, and education associated with space science and technology".

20. "Administration Recommends One-Year Extension of National Council on Marine Resources and Engineering Development", Executive Office of the President, National Council on Marine Resources and Engineering Development, 10 March 1969, 1 p.

This Executive release reports that "in testimony before the Subcommittee on Oceanography of the House Committee on Merchant Marine and Fisheries on March 7, Dr. Edward Wenk, Jr., Executive Secretary of the National Council on Marine Resources and Engineering Development, recommended extension of the lifetime of the Council until June 30, 1970". The Council was established in 1966 "to advise and assist the President in developing a comprehensive program in marine science affairs, and coordinated activities of the Federal departments and agencies involved". Initiated as an "interim mechanism", the Council's lifetime was first extended after submission of the Report of the Commission on Marine Science, Engineering and Resources in January 1969. President Nixon has requested that the Council continue to advise and assist him for at least another year.

21. "Establishment of National Oceanographic Instrumentation Center", Executive Office of the President, National Council on Marine Resources and Engineering Development, 14 February 1969, 2 pp.

The National Council on Marine Resources and Engineering Development has announced the "establishment of a National Oceanographic Instrumentation Center to serve the needs of Federal Government agencies and of the industrial and scientific communities". The Center, which will draw from the resources of several agencies, will serve as a focal point for developing basic instrument standards, providing uniform calibration of instruments, improving availability of information in instrument design and performance, and supporting U.S. participation in development of international instrument standards".

22. Vahle, C.W., Jr., "Planning and Coordinating Oceanographic Programs", PB 182 602, Operations and Policy Research, Inc., Washington, D.C., 17 April 1969, 55 pp.

The interagency mechanism used by the federal government to plan and coordinate oceanographic programs from 1959 to 1966 is described in terms of its origins, organization, function, and effectiveness. The study focuses on the activities of the three organizations comprising the coordinating mechanisms: the Federal Council for Science and Technology, the Interagency Committee on Oceanography, and the Office of Science and Technology. Topics covered in the study include the circumstances leading to the creation of a coordinating system, organization and functioning of the system, coordination of policies and programs, and the achievements and weaknesses of the system

in program planning and budgeting. It is concluded that the system "had a good record ... in coordinating interagency programs", that it had "some notable achievements ... in program planning and budgeting" but also several weaknesses, including an "inadequate planning system, lack of authority to develop a national program, lack of influence with member agencies, and poorly phased council activity".

(This report may be obtained from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Va. 22151, Price \$3.00).

23. "Selecting Policies for the Development of Marine Resources", PB 180 905, Commission on Marine Science, Engineering and Resources, Washington, D.C., (Resources for the Future, Inc.), 6 March 1968, 54 pp.

A policy framework, and illustrative applications of it, are presented for the resources component of a national oceanographic program. The framework, which is broad and general, consists of an objectives-activities matrix (that expresses the national interests and the types of activities that can be used to realize the objectives), cost-benefit analysis techniques for choosing from among alternative courses of action, and a step-wise procedure for using the framework. Within the framework, the roles of government and private industry are discussed, with the conclusion that policies in this area will be chiefly concerned with "regulating, stimulating, and guiding private effort" and "in removing obstacles currently in the way of private effort". The framework is applied to four areas of policy decision dealing with marine resource development: marine technology, accelerated development of marine resources, off-shore oil and gas leasing, and the rehabilitation of commercial fisheries. For each of these areas, the character of the problem is described, its relevance to national objectives is discussed, and alternative policies are assessed.

(This report may be obtained from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Va. 22151, Price \$3.00).

24. Danhof, C.H., "Interdependencies Between Public and Private Interests in the Advancement of New Technologies", PB 182 600, Commission on Marine Sciences, Engineering and Resources, (The George Washington University, Washington, D.C.), December 1968, 67 pp.

Past policies and processes used by the federal government to generate and disseminate new technologies are reviewed for their relevance to "the promotion of technological advance in oceanography". Among the mechanisms reviewed for promoting new technologies are national programs initiated by the government tax incentives, cost-sharing contracts, government underwriting, and purchasing. Programs illustrating these mechanisms, and their associated policies and

issues, are presented. Several mechanisms for transferring technology are also described and illustrated. These include the contractual system, "transfer by people transfer", open literature, patents, and regulatory procedures. From the review, the author makes two broad observations: "the advancement of any technological objective is best assured by maximizing the involvement of ... private individuals and organizations" and the organization responsible "for technological advancement in oceanography" should have authority to select the "arrangements" it judges to be most effective. The government's role in R&D is the "exercising of leadership in establishing objectives, selecting courses of action, and providing funds"; a "non-delegable function ... is the establishment and application of priorities in the expenditure of public funds".

(This report can be obtained from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Va. 22151, Price \$3.00).

25. Schoettle, E.C., "Civilian-Military Interest in New Technologies", PB 182 601, The George Washington University, Washington, D.C., September 1968, 78 pp.

The present and prospective interdependencies between civilian and military interests in and responsibilities for marine sciences are discussed. The paper "selects problems and experiences in handling civilian military interdependencies of previous technological programs" that are "relevant to the kinds of interdependencies expected to arise in the field of marine sciences, engineering and resources". The general sources of interdependence in the advancement of new technologies are cited and discussed (e.g., the continuity and indivisibility of the R&D process, and the dependence of military preparedness on R&D); the interdependencies in current marine sciences programs are reviewed; and the problem arising from interdependencies in marine sciences and other areas are surveyed. From these analyses, it is concluded that there will be a "thrust towards organizational consolidation" because of the high costs of developing engineering technology. Three forms of consolidation are considered: a single civilian agency, a single military agency, or two agencies, one civilian and the other military. The author eliminates the first alternative, because of the Navy's stakes in the area, but believes that "serious attention should be given to the other two alternatives".

(This report may be obtained from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Va. 22151, Price \$3.00).

26. Watkins, H.D., "SST Study Yields Negative View", Aviation Week & Space Technology, v. 90, no. 12, 24 March 1969, p. 29.

An ad hoc committee established by President Nixon to review the supersonic transport program has submitted a generally negative report to Transportation Secretary John A. Volpe. "The report is one of several key sources of advice which Volpe will use to make his recommendation to President Nixon as to what steps to take next with the prototype program. Some of the reasons that led to the negative reports include: (1) Uncertainty concerning technical risks and ability to build the aircraft for the stated costs within the time limit; (2) Questionable market for the aircraft -- it is estimated that 300 aircraft must be sold to return the government's investment; (3) "Uncertainties over the balance of payments and economic viability of the aircraft in service". Other inputs include the recommendation of the Federal Aviation Administration and the Massachusetts Institute of Technology. Both are believed to urge proceeding with prototype construction. U.S. airlines which evaluated the new Boeing design generally have recommended to Volpe that the prototype construction begin. "If the program is to proceed ... President Nixon will have to request an additional appropriation from Congress of about \$250 million for Fiscal 1970".

27. Watkins, H.D., "Pressure Grows to Delay SST Prototype", Aviation Week & Space Technology, v. 90, no. 13, 31 March 1969, pp. 29-30.

Forces influencing the fate of the supersonic transport proposed for 1970 are discussed and the implications of the delay in the program are examined. The major reason for delaying actual construction in favor of continued R&D for another year are monetary: prototype construction will entail an appropriation of about \$250 million as compared to about \$70 million for research. Advocates of immediate prototype construction base their position on these points: (1) "the total cost of the program would be increased by the cost of marking time"; (2) "delay could ... cause a serious loss in morale and program momentum; (3) manufacturers involved in the program "could seek adjustments to compensate for added costs and risks resulting from delay"; (4) an advanced Anglo/French Concorde supersonic transport could be introduced before the United States entry was ready. Nixon has asked Science Advisor DuBridge to conduct a separate study of the "technical and economic aspects" of delay vs. construction; and Transportation Secretary Volpe will make his suggestions to the President after reviewing reports prepared by FAA and NASA.

28. Friedman, S., "Realignment of IBP Programs", BioScience, v. 19, no. 2, February 1969, pp. 153-154.

The recent reorganization of the International Biological Program (IBP) and the development of its "integrated research programs" are discussed. The research programs took form after a

meeting of the National Committee of the IBP in November 1966, during which each subcommittee "drew up a program of research goals in its respective field". How "these 'goals' have been converted into research designs and the designs into programs" is described. There are now 13 existing and five potential programs centered around the theme of man's adaptation to a changing environment. The National Committee has also been reorganized and "is now composed of a six-member Executive Committee, which monitors research activities and tries to maintain central coordination for all programs". "Assisting and advising the executive Committee are two groups -- the Program Coordinating Committee ... and the International Coordinating Committee". The function and composition of each committee is described.

V SCIENCE, EDUCATION, AND THE UNIVERSITY

16. Caldwell, L. K., "Science and Public Policy in the American University", Indiana University, Bloomington, Indiana, 1 March 1969, 55 pp.

The six papers assembled in this collection were prepared for a conference, which was jointly sponsored by Indiana and Purdue Universities. "The purpose of the conference was to report the results of a two-year study of university curriculum development in science and public policy undertaken by the sponsoring universities under a grant from the National Science Foundation". The titles and authors of the six papers are listed.

- "Public Needs and University Responsibilities in the Development of Public Policy for Science and Technology" (Senator Fred Harris)
- "Why Science and Public Policy?" (Don E. Kash)
- "University Programs in Science and Public Policy" (Eugene B. Skolnikoff)
- "Collaboration Among Specialists: Some Problems and Possibilities" (Claire Nader)
- "Some Problems of Curriculum Development" (Lynton K. Caldwell)
- "Reviewing American Science Policy" (Philip B. Yeager)

17. Long, F. A., "Support of Scientific Research and Education in Our Universities", Science, v. 163, no. 3871, 7 March 1969, pp. 1037-1040.

The problems, prospects, and policies for the federal support of scientific research and education in universities are discussed and suggestions are offered for what universities should do to "obtain the support we all know our programs need". The author briefly reviews the major elements of the present policies and discusses their implications and prospects for the future. The significance of current reductions in federal funding is discussed and related to the "overall public disaffection with science and science education". Several general suggestions for steps that universities should take to counteract these problems are offered: (1) first, emphasis must be placed on the university as an "educational institution" not as an agency for research; (2) "the synergistic linkage between teaching and research" must be stressed and documented; (3) "the importance of basic research to our nation's progress" must be made more explicit; (4) the effectiveness and efficiency of university programs must be improved; (5) scientists and engineers must participate to a greater

degree in the applied research needed for attacking the "great sociotechnologic problems" of today; and (6) the university must obtain greater support from the federal government as well as from state and local governments, industry, and foundations.

18. "Doctorate Recipients from United States Universities: Summary Report 1968", National Research Council, OSP-MS-2, April 1969, 9 pp.

This, the second in a series of yearly summaries, presents statistical data for doctorates earned during the period July 1967 - June 1968. The data include the number of research doctorate recipients by field and subfield, profile of recipients (e.g., male-female, age at doctorate, post-doctoral work activity), sources of graduate support, and the states from which the doctorates were received. Overall, U. S. universities granted 22,834 doctorates in 1968, up 12.5 percent over 1967. The physical sciences and engineering accounted for 32 percent of the doctorates, the biosciences 16 percent, and the social sciences 15 percent. Growth rates in the major fields have changed radically during the past year: the biological sciences show the most dramatic increase in rate (18.1% vs. 8.6% in '66-'67) and the physical sciences suffered the largest decrease (7.1% vs. 13.5% in '66-'67).

(The report can be obtained from the Office of Scientific Personnel, National Research Council, Washington, D.C.)

19. "The Draft Laws", BioScience, v. 19, no. 3, March 1969, pp. 254-255.

"In a report subtitled Much Ado About (Almost) Nothing, the Stanford Research Institute has issued the results of a survey made in the fall of 1968 to determine the impact of the present draft laws on male enrollment in American graduate schools". The results of the study "definitely suggest that the Selective Service System was right and the proponents wrong, at least for the fall, 1968, term". "Of the universities in the survey only 10.3% (35) reported that the effect of the draft law on male graduate enrollment was 'considerable', while 54.3% (185) reported the effect as 'not noticeable'. The surveyors also compared the 1968 dropout rate of male graduate students with normal dropout rates and found that 21.9% (65) universities reported a higher rate, while 3.7% (11) reported a lower rate. The dropout rate remained the same according to 74.4% (219) of the respondents". "In summarizing the comments from the respondents, the authors trace the initial fears concerning the revised laws to statements by one or two academic manpower experts 'who badly misjudged the situation'. They also state that feelings remain prevalent among respondents that the day of reckoning has merely been postponed until the spring or fall of 1969. Although they concede that this 'delayed action' syndrome has a legitimate basis, the authors find little hard evidence to support the assumption that the impact of the law will be any greater in 1969 than in 1968".

20. "Nearly Half of All Graduate Students Eligible for Draft", Physics Today, v. 22, no. 3, March 1969, pp. 65-66.

The impact of recent Selective Service System draft calls on graduate departments is discussed. "Almost half of all first and second-year physics graduate students are eligible for the draft". A survey of 1237 science departments by the Scientific Manpower Commission revealed that about 1000 students enrolled for September 1968 entered military service instead of graduate school. Mrs. Betty Varner, Commission executive secretary, predicts that "a substantial loss of current first and second-year graduate students inevitably will reduce the size of advanced PhD-candidate classes next year and in the two years following; and lead to a serious reduction in new PhD-trained professionals available to serve the nation's needs during the early 1970's".

21. "Implementing the NSB Proposals", Science News, v. 95, 29 March 1969, p. 306.

Senator Fred Harris has introduced a bill "to establish a National Institutional Grants Program to substantially increase, by \$400 million, support of scientific research and education from the community college to the university level. The money, which each year after 1970 would equal 20 percent of total Federal funds for academic science, would go directly to the institutions, rather than to the individuals within them, and could be used by the schools to support programs of their own choosing. The distribution would be administered by the National Science Foundation. The bill has been referred to the Senate's Committee on Labor and Public Welfare". In the House Representative Miller "has introduced legislation also aimed at marshalling support for university science". "His proposal is to distribute funds by a complicated formula incorporating proportions of graduate and undergraduate students, designed to feed less wealthy institutions, in more states".

22. "University R & D Grants Stalled", Industrial Research, v. 11, no. 4, April 1969, p. 25.

Representative George P. Miller has introduced a new "Miller Bill" into the House, which will "provide \$400-million during fiscal year 1970 in addition to what federal agencies already are spending on academic science". Under this new bill, "the social sciences also would share in the money, allocations would be based on undergraduate as well as graduate enrollments, and the proposal would be open-ended to provide future year outlays equal to 20% of what had been spent by all federal agencies on academic science during the previous year". "To satisfy the complaints that previous Miller Bills would have rewarded those institutions already receiving plenty of government funds, the new version apportions the funds on three bases:

one-third based on the amount of money each institution received from the government during the previous year ... Another third apportioned on the basis of fulltime undergraduate students ... A final third based on the proportion of advanced degrees awarded". "Administration witnesses, such as Presidential Science Advisor Dr. Lee DuBridge, NSF Director Dr. Leland Haworth, and National Academy of Sciences President-elect Dr. Philip Handler were generally in favor of the bill, but could not be emphatic in their support since they lacked direction from the House".

23. Walsh, J., "Miller Bill Endorsed in Hearings, But Critics Muster", Science, v. 163, no. 3891, 7 March 1969, p. 1045.

The proceedings from the final hearings on the "Miller Bill" are discussed. The bill, which would give a "substantial boost to science education in the universities through a program of institutional grants", won "strong endorsement from witnesses representing higher education institutions ... and from leaders of the scientific community". However, the priorities implied in the institutional-grant approach were criticized. The following are some of the criticisms: (1) An "institutional-grants program could reopen the church-state issue, block effective national planning to meet problems in higher education, and result, in many cases, in university and college wage boosts without accompanying improvements in the quality of education"; (2) "The Miller Bill would put a major higher education aid bill under the wing of the Science and Astronautics Committee rather than the House Education and Labor Committee. Since no member of the House Education and Labor Committee was invited to testify ... the attitude of the members ... is known to be less than receptive". "Both Miller and Daddario seem to feel that the hearings enhanced the bill's chances to advance, and a new and improved version is likely to be drafted and introduced". It is felt that the unanimous support "may be due in part to the desperation about finances that is increasingly being felt throughout higher education".

24. Pettit, L. K., "Congress, Confusion, and Indirect Costs", Science, v. 163, no. 3873, 21 March 1969, pp. 1301-1305.

"Indirect costs" for government-financed university research is discussed, with emphasis on the proposed Mansfield Amendment to limit overhead costs on Department of Defense (DOD) research contracts and grants. It is pointed out that universities "help defray the indirect expenses of maintaining federally funded projects", that the distinction between direct and indirect costs is artificial, and that Congress mistakenly regards support for an individual scientist as a subsidy to the university because of the failure to distinguish

between the academic and scientific communities. Several "plausible reasons" for the Mansfield Amendment are suggested, including the concern over the size of the defense budget and the consequent influence of DOD, the imbalance between teaching and research, the inequitable distribution of research funds geographically, and the felt need for congressional monitoring of the research enterprise. A "more proximate explanation for the amendment's introduction" is the "ambiguity" of a letter to Mansfield from Philip Handler (Chairman of the National Science Board) which failed to explain "just what indirect costs are". Several actions are suggested for the academic community to take, including clarification of indirect costs, assertion of the university administration's role as "the legitimate spokesman of higher education in the policy-making process", acceptance of research contracts and grants only if they pay all indirect costs, more uniform accounting procedures, and the promotion of "general-purpose federal support for higher education institutions".

25. "Mansfield: Tighter Administration of Research Grants", Scientific Research, v. 4, no. 6, 17 March 1969, p. 19.

"Aides to Senator Mike Mansfield, one of the loudest critics of overhead allowances paid to holders of federal research grants, say his attack on such allowances last year was primarily a stopgap measure. He is trying to get at two problems: finding more uniform methods of accounting for costs, and waste and duplication in federally financed research. Mansfield's principal objective this year will not be to reimpose a ceiling on overhead costs, but rather to force agencies supporting research to exert tighter control over costs. A study by the General Accounting Office, due shortly, is expected to help in formulating guidelines for accounting. In addition agencies will be pressured to keep a check on what other agencies are doing. Says one Mansfield aide: 'The scientific community admit they go from one guy to another with a project they want to get funded, to see which faucet leaks the most We'll make each agency justify its r&d budget items more carefully. There will be some reshuffling; some research budgets will go up, some down'".

26. Nelson, B., "M.I.T.'s March 4: Scientists Discuss Renouncing Military Research", Science, v. 163, no. 3872, 14 March 1969, pp. 1175-1178.

The March Fourth activities at M.I.T. centered around discussions by noted scientists of "how the misuse of scientific knowledge endangered man". The "Movement", which was initiated by three physics graduate students and supported by 47 senior faculty members, spread to approximately 30 other universities. One of the themes developed at M.I.T. "was the need for scientists and engineers to concern themselves more

with the uses to which their research and knowledge were put". Speakers criticized the "ethical neutrality" and "political passivity" of scientists and engineers. Nobel prize-winning biologist George Wald of Harvard argued that our government had "become preoccupied with death", not the preservation of life, and he also "deplored a trend for scientific organizations to develop large bureaucracies in Washington which built up their associations with the Defense Department to keep occupied". He was especially critical of the National Academy of Sciences and the American Institute of Biological Sciences for their Defense Department connections. The writer describes some of the difficulties faced by student activists in organizing what the Boston Globe was to call "the most orderly and, perhaps for that reason, the most persuasive anti-war and anti-government policy demonstration yet seen".

27. Langer, E., "A West Coast Version of the March 4 Protest ... At Stanford -- Convocation, Not Confrontation", Science, v. 163, no. 3872, 14 March 1969, pp. 1176-1177.

March Fourth activities at Stanford University, in which about 1200 to 1500 took part, took the form of a "forum for discussion" in which scientists and engineers from both industry and the university were invited to participate. The program "had the support and active participation of most of the scientific luminaries on the Stanford campus", but few representatives from private firms took part. The discussions centered around the idea that "science and technology are having effects on society in ways that are not intended". Speakers addressed themselves to such diverse topics as: "nationalism as a contributing factor to the world's dilemmas", the ABM, support for basic research, the "military-industrial-university complex", and chemical and biological warfare. The writer believes that the "March 4 observance at Stanford was not much of a setback for the military-industrial complex But it was perhaps the first infusion of a comparatively large and public interest into questions of scientific policymaking that had occurred in a long time, and it may be that it is a portent".

28. "Research Strike: Opposed, Ignored", Chemical & Engineering News, v. 47, no. 11, 10 March 1969, p. 12.

The March Fourth movement, which called for a "one-day research strike" at universities, "stopped little research". The strike was designed to draw university scientists' attention to their role in matters of defense. However, participation at universities across the nation was varied. Few science faculty members at Columbia stopped their research to attend science policy workshops during the day; substantially more attended an evening forum after their day's work. Harvard appeared unaffected by the movement and only about 500 at the University of Wisconsin attended a "late afternoon

teach-in on the 'misuse of science'". At the Argonne National Laboratory 83 employees staged a counter "16-hour work-in" and a few others attended a teach-in at Northwestern. "There was also an all-day discussion session at Case Western Reserve University on the social responsibilities of science". John Ross, chairman of M.I.T.'s chemistry department, pointed out that the "strike was a gesture. The important thing about it will be what happens afterwards". The article suggests that "the idea of such a strike generated a lot of discussion on the question of federal government research priorities, which are now heavily weighted toward military technology, and other science policy issues".

29. "White House Directive", Science, v. 163, no. 3872, 14 March 1969, p. 1181.

"Expensive research equipment and facilities in federal laboratories are expected to be more readily available to university scientists working on their own research projects as a result of a directive from President Nixon. The action follows a 2-year investigation by the Committee on Federal Laboratories of the Federal Council for Science and Technology. The directive allows federal agencies to pay research costs at the Federal facility when a university investigator's project is consistent with the goals of the federal laboratory. All costs of research not directly related to the agency's mission must be paid by the university. The directive applies to all federal agencies and would make more uniformly available to scientists such facilities as atomic laboratories, national health research facilities, and agricultural research stations. It is left to directors of local facilities to decide which university proposals will be accepted".

30. "Engineering Enrollment Declines", Science, v. 164, no. 3876, 11 April 1969, p. 167.

"A survey of 270 schools of engineering indicates that full-time graduate student enrollment in engineering in 1968 in these schools is down 16 percent from 1967. The survey, conducted by the Engineering Manpower Commission of the Engineers Joint Council, shows the total number of full-time graduate students in engineering declined from 49,610 in 1967 to 41,530 in 1968. The Commission says that graduate school enrollments in engineering have risen steadily since World War II at a rate of about 12 percent per year and that the 1968 reduction represents a first and 'dramatic decline'. Engineering Manpower Commission officials attribute the decline to a change last year in the draft regulations, which has had the effect of cutting full-time graduate student deferments, except in the medical sciences".

31. "NSF Institutional Grants Program Opens", Washington Science Trends, v. 22, no. 1, 14 April 1969, p. 2.

"The National Science Foundation has advised colleges and universities they can now apply for funds under the Institutional Grants for Science program which permits institutions to use 'their own judgement' on how the money is to be spent. The program has been changed this year, since the computation of grants will be based on the total amount of Federal research funds received by the institution, except for funds from the U. S. Public Health Service. Previously, the formula was based solely on other NSF funding. The Foundation's only limits are that the money must be used for science, social sciences, mathematics and engineering, and cannot be used for indirect costs. Because of the new 'broader base' and because of the need to juggle spending under budgetary limits, the awards will not be made until September or October, three or four months later than in past years".

VI SCIENCE MANAGEMENT AND POLICY-MAKING BODIES

11. Brown, F.R. and Chitwood, S.R., "Highlights From the Literature on Organization for Federal Programs in Science and Technology", PB 182 603, Commission on Marine Science, Engineering and Resources, The George Washington University, July 1968, pp. 138.

Selected literature on organizational arrangements for federal government programs in science and technology is reviewed and analytically summarized. "The objective has been to provide an orderly and concise synopsis of recent thought concerning the most significant and unique factors requiring consideration when organizing and structuring Federal programs of this nature". The first of the four chapters of the report deals with the determinants of organizational effectiveness (e.g., structure and strategy, activities and processes); the second with modern organizational theory and practice; the third with federal government organizations in terms of structure, conflicts, coordination, etc., and the fourth with federal organization specifically for science and technology. Among the questions and issues raised in the latter chapter are the differences between science and technology, centralized vs. diffuse structure for government science, the coordination processes, and the extent and nature of the involvement of the scientific community.

(This report can be obtained from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Va. 22151, Price \$3.00).

12. Brezina, D.W., "The Congressional Debate on the Social Sciences in 1968", Staff Discussion Papers 400, The George Washington University, December 1968, 21 pp.

Congressional activity and hearings on the social sciences in 1968 are reviewed and analyzed. This includes the Fullbright hearings on the Department of Defense testimony of John Foster (Director, Defense Research and Engineering) and Admiral Hyman Rickover, the Magnuson hearings on the support of the social sciences by the National Science Foundation (NSF), and the NSF Reorganization Act. From the analysis, the author concludes that "the social sciences are vulnerable to political attack from a number of directions and for a variety of reasons"; this vulnerability is attributed to the "relatively insecure position" of the social sciences "in science agencies or science programs where the natural and life sciences predominate, and to "their controversial nature, derived by their tendency to focus on the most pressing problems of American society". "Until their political base is strengthened through Congressional action,

possibly with the creation of a new agency, the social sciences will tend to be buffeted around the political arena and in large part be deprived of contributing to their fullest potential".

(The report can be obtained from the Program of Policy Studies in Science and Technology, The George Washington University, Washington, D.C.).

13. "Social Science Foundation", Science, v. 163, no. 3872, 14 March 1969, p. 1181.

"A Bipartisan bill to establish a National Foundation for the Social Sciences, similar to the National Science Foundation (NSF), is likely to receive more notice in Congress this session. Twelve senators have added their names to the bill this year. The measure now has 32 cosponsors, including Senator Ralph Yarborough (D-Tex.), the new chairman of the Labor and Public Welfare Committee, which is expected to handle the bill. The measure, reintroduced by Senator Fred Harris (D-Okla.), would establish a foundation with broad powers for the support of research, education, and training in the social sciences. The measure also calls for a yearly authorization of \$20 million".

14. Price, W.J., "The Case for Agency Research", Bulletin of the Atomic Scientists, v. 25, no. 4, April 1969, pp. 34-36.

In response to recent critics of support for university research by mission-oriented agencies, a case is presented "for the multi-agency support structure by discussing its broader value and its overall importance to the agencies, the universities, and society". The author, executive director of the Air Force Office of Scientific Research, points out that the mission-oriented agencies perform two important functions through their involvement with the universities: communication of science activities among the world scientific community, and support and improvement of the "coupling function" -- "the dialogue between the scientific and technological communities". Several mutual benefits of the relationship are cited: "support makes possible ... scholarly research which is essential for the university education and research functions"; "it ... provides the university with desired opportunities for suitable involvement in the broad concerns of society"; and "it helps increase the general availability and the amount of research funds for the support of science".

15. Daddario, E.Q., "Scientists and Legislators", BioScience, v. 19, no. 2, February 1969, pp. 149-151.

The legal requirements for participation of nonprofit scientific and technical societies in science policy issues are discussed, and some problem areas in which such societies could take a role are cited. Representative Daddario reviews the restrictions placed on tax exempt societies, and concludes that they can take a much more active role in formulating science policy than they now do, without fear of losing their tax exempt status. Several areas for such participation are mentioned: thermal pollution from power plants, invasion of privacy through cybernetics, organ transplants, and air pollution. In addition to these, two other areas, both of which are under the jurisdiction of Daddario's subcommittee, are identified as needing inputs from scientists and engineers. The first of these is "technology assessment", which is concerned with 'identifying, assessing, publicizing, and dealing with the implications and effects of applied research and technology'. The second is the annual authorization hearings for the National Science Foundation, for which the author solicits comments on the "strong and weak points of the Foundation, as what programs should receive greater or lesser emphasis".

16. "Daddario on the Weston Accelerator", Science, v. 163, no. 3872, 14 March 1969, p. 1183.

The following excerpt is taken from the Ferguson Lecture for 1969 delivered at Washington University in St. Louis on 12 February 1969 by Rep. E.Q. Daddario. In the part of the address preceding this excerpt, Daddario talked about the difficulty of finding any articulated federal science policy and of finding out how policy is related to scientific decisions made by the federal government.

"Let's take one example -- the 200 BEV accelerator proposed for Weston, Illinois. You may be, and probably are, much interested in the 'policy' machinations which resulted in a decision to go forward with this highly publicized, highly expensive bit of 'big science'. I am too. But I must confess I do not know what they were. What rationale is behind the priority given to the accelerator? (Not that given to the facility itself.) Who was most responsible? The National Academy of Sciences? The Congress? The Atomic Energy Commission? The National Science Foundation? The Office of Science and Technology and the Federal Council? The President's Science Advisory Committee? Or was it the remnants of the old World War II M.I.T.-Los Alamos axis whose guiding lights are sometimes alleged to have been dominating U.S. science ever since? What logic actually governed the

selection of the site? And, in this case, did an "in-group" make the recommendation; if so, was its real advice followed? These are questions on which we have all read much and speculated much. Certainly, they are questions of policy. Just as certainly, very few know the answers, and I sometimes wonder if anyone knows them all. But the point here is to suggest that many of the important details of federally assisted scientific endeavor in this country are decided without being responsible to any policy, formal or informal ..."

17. "Harris' Committee May Be Phased Out", Science, v. 163, no. 3871, 7 March 1969, p. 1042.

"The Senate Government Research Subcommittee, which gave Senator Fred Harris (D-Okla.) a foothold as an influence on scientific affairs in the Senate, is scheduled to be phased out in September. Harris, who is chairman of the subcommittee, has also been serving as Democratic National Committee Chairman since his appointment to the post in January. He will continue to serve as chairman of the Government Research Subcommittee until it is disbanded. Senate sources say the committee phaseout is part of a plan to reduce the number of Government Operations Committee subcommittees. These sources say that Harris' subcommittee would be the first to go because Harris has less seniority than other subcommittee chairmen. There is some speculation, however, that in the politicking that is likely to occur his subcommittee could be saved".

18. "House Government Operations Reorganizes", Science, v. 164, no. 3877, 18 April 1969, p. 280.

"House Government Operations has abolished its Research and Technical Problems subcommittee, chaired by Representative Henry S. Reuss (D-Wis.), who has accepted the chairmanship of another subcommittee, Conservation and Natural Resources. In disbanding the subcommittee, Government Operations has cut the only subcommittee which handled broad, interagency research matters. The committee plans to reassign some of its functions to other subcommittees which have individual agencies under their jurisdiction. Capitol Hill sources say that the new Reuss subcommittee will conduct an in-depth study of government pollution research and development activities. A special studies subcommittee, chaired by Representative John S. Monagan (D-Conn.) is expected to handle some of the functions of the disbanded subcommittee. The Government Operations Committee's organizational change, which resulted in a reduction in the total number of its subcommittees from 11 to 8, follows criticism last year by the House Administration Committee, which charged that Government Operations had too many subcommittees, some of which were relatively inactive and expensive to operate".

19. "National Science Foundation: Annual Report, 1968", NSF 69-1, National Science Foundation, Washington, D.C., 1968, 279 pp.

"This 18th Annual Report of the National Science Foundation presents an account of major activities in support of scientific research and education in the sciences during fiscal year 1968". The discussion of direct support for research is arranged, insofar as possible, by major fields of science rather than by correspondence to the administrative structure of the Foundation. "Other programs, however, which cut across scientific disciplines and provide support for science education and institutional development, are presented individually as program elements having multiple objectives. One example of this type of program (among a number of others) is found in Foundation support for computing activities in research and education, which assumes separate organizational status for the first time in fiscal year 1968". "The financial statement for the year is presented as appendix B, and various component or supporting data are included where appropriate in the description of activities. Data on prior years are also presented where such information may be useful for purposes of comparison". An index, intended to facilitate a better understanding of the relationship between program activities and the broader objectives of the Foundation as a whole, is also presented.

(This report may be obtained from the U.S. Government Printing Office, Washington, D.C. 20402, Price \$1.25).

20. Boffey, P.M., "Nixon and NSF: Politics Block Appointment of Long as Director", Science, v. 164, no. 3877, 18 April 1969, pp. 283-284.

Reasons for the blockage of the appointment of Franklin A. Long as new director of the National Science Foundation by high level members of the Nixon administration and consequences of that blockage are discussed. "The stumbling block was apparently related to Long's liberal positions of arms control and disarmament". Long's work for arms control in the United States Arms Control and Disarmament Agency and in other arms control groups, as well as his recent article expressing reservations about ABM deployment may have been influential. Democratic Party affiliation may also have played a part in the veto. The author concludes, "The blocking of Long is sure to cause fireworks in the scientific community, for many of the nation's leading scientists believe he would have made an outstanding director of NSF, an agency which will spend some \$490 million this year in support of basic research and scientific education". An important issue arising from this affair is whether "a man's views on

military matters should disqualify him from the directorship of a purely civilian agency". The writer believes that the incident may strain relations between the Nixon Administration and the scientific and academic communities.

21. Boffey, F.M. and Nelson, B., "NSF Directorship: Why Did Nixon Veto Franklin A. Long?", Science, v. 164, no. 3878, 25 April 1969, pp. 406-411.

Reasons why Long was rejected as director of the National Science Foundation and the storm of protest the rejection raised are examined. The authors explain how and why Long was nominated by the National Science Board and describe the events leading up to the surprising cancellation of the appointment announcement. Congressional opposition from Senators Dirksen and Fulton appears to have played an important part in stopping the appointment. Reasons for the blockage appear to be political, and the authors believe that the main objection centers around Long's views on the ABM which differ from those of the administration. Another objection cited was fear that Long would change the direction of NSF to include "controversial matters like social science support" or social policy. Most opposition to Long's veto appears to center around the issue of the "politicalization" of the NSF. Possible negative consequences of the incident for NSF, for the President's science advisor, DuBridge, and for relations of the administration with the scientific community are discussed.

22. "NIH Tries Troika Leadership", Scientific Research, v. 4, no. 6, 17 March 1969, pp. 11-12.

The appointment of Robert W. Berliner, M.D. as deputy director for science and John F. Sherman as deputy director for administration by NIH director, Robert Q. Marston, is discussed. The "troika arrangement" is an attempt to manage this vastly complex organization which has grown from seven Institutes with a \$71 million budget in 1955 to eleven Institutes and two divisions with a \$1.54 billion budget. Berliner is responsible for "all NIH research, grants and contracts", "long-range planning and research policy" and directs the laboratories and clinics at NIH as well. Berliner's position on certain key issues is examined. Regarding policy during times of "budget stringency", he believes it is "more important to keep the NIH in-house research team together than to keep university research programs fully funded", but he does not see any immediate threat arising from recent cutbacks to university research. He also believes that the solution to health manpower problems will come from research itself, not from manpower training. Berliner's qualifications for this appointment and his current research activities are also discussed.

23. "R&D Funding: Nonprofit Groups' Role", Chemical & Engineering News, v. 47, no. 8, 24 February 1969, p. 14.

"The General Accounting Office has recommended a Presidentially directed study to define the 'proper role' of Government-sponsored, nonprofit research organizations, such as Brookhaven National Laboratory and the Jet Propulsion Laboratory in Pasadena, Calif. The study would determine whether the Government's research and development missions could best be performed in-house, by sponsored nonprofit organizations, or other groups". "Another much bolder recommendation is that a government policy be established to guide federal agencies in contracting with research organizations". "GAO's report, 'Need for Improved Guidelines in Contracting for Research with Government-Sponsored Non-Profit Contractors', stems from the office's review of federal agency practices and policies for fee payment. Federal expenditures of these fees amount to \$9 million annually. But the total annual expenditure is less important than the question of what organizations do with the fees, GAO says. It finds that fees paid to nonprofit groups and methods for determining the fees vary significantly among government agencies. As an alternative to the Presidential study, GAO recommends that the Budget Bureau prescribe the contract guidelines and, together with the Civil Service Commission, determine what types of organizations could best assist the Government in fulfilling its R&D mission".

24. "Scientists Promote Political Role", Science, v. 164, no. 3875, 4 April 1969, p. 52.

"A group of about 100 scientists, mostly physicists, have banded together to take a more active role on political and environmental questions which affect them. Scientists for Social and Political Action, organized by Charles Schwartz at the University of California and Martin Perl of Stanford University, held its first official meeting at the American Physical Society meeting in New York". "A main concern of the group is that scientists have become more and more dependent on the government, particularly the Defense Department, for research funds. Members plan to stress a sharp division between scientific and military interests; they will offer their services as science advisers to local citizens and the government".

25. "Government Patent Policy Study", Final Report, Volume I, Federal Council for Science and Technology, Committee on Government Patent Policy, U.S. Department of Commerce, Washington, D.C., Harbridge House, Inc., Boston, Massachusetts, 1968, 57 pp.

"This volume is part of the final report submitted by Harbridge House, Inc., to the Committee on Government Patent Policy, Federal Council for Science and Technology". This Volume I summarizes the results of the research on the study questions. The remaining three volumes provide back-up data and more detailed reports. "The primary purpose of the Harbridge House study has been to provide government policy-makers with data to evaluate the effectiveness of government patent policy in achieving policy objectives. The study sought answers to three basic questions which underlie the government's objectives concerning patents arising out of government contracts: (i) How does patent policy affect commercial utilization of government-sponsored inventions? (ii) How does patent policy affect business competition in commercial markets? (iii) How does patent policy affect participation of contractors in the government's research and development programs? A three-phase study effort was undertaken to answer these questions: In phase one, existing data was gathered to determine what relevant information was already available. Phase two consisted of a utilization questionnaire survey to gather a broad body of new data on a large sample of government-sponsored inventions. And, phase three involved case studies of inventions and contractors in the utilization survey to develop a fuller understanding of the effects of patent policy on them".

VII SCIENCE, FOREIGN AFFAIRS, AND NATIONAL DEFENSE

8. "DuBridge Discusses Defense R & D", Science, v. 164, no. 3876, 11 April 1969, p. 168.

"Presidential science adviser Lee A. DuBridge ... addressed a conference on social control of science and its applications at the University of Chicago. In the course of his remarks he discussed what he feels to be the responsibility of scientists and engineers to participate in defense research and development 'until firm disarmament agreements are reached'". "The question ... is not whether we need the help of scientific and engineering knowledge and talent to insure the defense of our country but how shall that talent be used to give us the most effective and economical defense system possible". DuBridge agrees that "it is not appropriate for secret military research to be carried on within university campuses", but he also points out that not "many universities do this now and others are free to phase out any classified weapons research which they are doing". Nevertheless, he does not agree "that universities should not accept any research support from the Department of Defense". Many agencies within DOD have supported basic research projects "without any visible relationship to weapons work and without any restriction on full publication of the results". DuBridge feels we have not "lost social control of science when we use scientific knowledge to help in the defense of the nation".

9. "Defense Science Board", Science, v. 163, no. 3874, 28 March 1969, p. 1434.

"The Defense Science Board (DSB), which is the senior advisory group on science and technology for the Defense Department, has five new members-at-large. They are Arthur T. Biehl of the Lawrence Radiation Laboratory, Lewis M. Branscomb of the University of Colorado, Daniel J. Fink of General Electric Corporation, Charles Herzfeld of International Telephone and Telegraph Corporation, and William G. McMillan of the University of California. The 28-member Defense Science Board, which consists of 20 members-at-large representing universities and industry and 8 ex officio members representing major federal agencies, meets periodically to assess scientific research and development for military purposes, and to advise the Director of Defense Research and Engineering (DDR&E). New members of DSB are appointed on the recommendation of the DDR&E. Robert L. Sproull of Cornell University is chairman of the board, a post which Frederick Seitz, president of the National Academy of Sciences, held from 1964 through 1968".

10. Dedijer, S. and Longrigg, A. J., "A Model of Foreign Research Policy", Scientific World, v. 13, no. 1, 1969, pp. 17-21.

A very general taxonomic model of international research relations is presented and briefly discussed. Intending to encompass more than just "scientific cooperation", "international research relations" is defined as "every pattern of exchange across national borders in which individuals, research production units, or national research organizations like councils, academies, etc., countries or groups of them mutually engage in (or refrain from engaging in) either to perform various processes in research separately or jointly, or to develop and use joint capacities for research". The major forms of such relations are defined and diagrammatically represented to illustrate the possible relations between two nations. Some of the changing factors of science and technology that "will greatly affect the existing forms of ... research relations" are mentioned, as well as the characteristics of nations themselves that influence the choice of relations, including their political systems and foreign policies.

11. "Multi-National Investment in Ocean Activities", PB 182 437, Institute for Politics and Planning, Arlington, Virginia, February 1969, 89 pp.

The effectiveness of existing institutional arrangements for financing and managing multi-national investments in oceanic endeavors are analyzed, alternative institutional arrangements are suggested and assessed, and steps for encouraging such investments are recommended. The study focuses on two facets of oceanography: world fisheries production and ocean observation. With respect to the first, the report reviews characteristics of the U. S. and world fishing industry, examines the potential for future investment by the developing nations, and discusses some existing measures for conserving and regulating fishing resources. New policies are suggested "which will capitalize on the present trend toward an integrated world economy, one in which U. S. food corporations play a major role in expanding the world fishing industry". With respect to the second area, ocean observation is said to be needed for weather forecasting and for improved information regarding fishing and off-shore drilling. The benefits from this effort, its costs and organizational responsibilities, are discussed.

(This report can be obtained from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Va. 22151, Price \$3.00).

12. "Scientists, Engineers, and Physicians From Abroad", Fiscal Years 1966 and 1967, National Science Foundation, NSF 69-10, Washington, D.C., 1969, 31 pp.

"This study, the sixth in a series prepared by the National Science Foundation to deal with foreign-born scientific man-

power, covers the extent and characteristics of the immigration into the United States in 1966 and 1967 of scientists, engineers, and physicians from all foreign countries". It should be noted that there are no means at the present time to measure the outflow from the United States of scientists, engineers, and physicians; thus, no information on the net drain is available. Some of the highlights of the study include (1) "More than 12,500 scientists and engineers and 3,300 physicians and surgeons were granted U. S. immigrant status in fiscal year 1967", (2) "The number of immigrant scientists and engineers in fiscal 1967 is roughly estimated to be about one-tenth as large as the gross addition to domestic scientific and engineering manpower", (3) "Nearly 2,300 scientists and engineers born in the United Kingdom represented the largest number admitted in 1967 from any individual country. India accounted for more than 1,500, the second largest number; mainland China, with fewer than 1,400, ranked third", and (4) "Of the immigrant scientists and engineers, 44 percent were under 30 years of age in 1967 and nearly 77 percent of the physicians and surgeons were 30-44 years in 1967.

(This report can be obtained from the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402, Price 45 cents).

13. "Brain Drain and Brain Gain", A Bibliography on Migration of Scientists, Engineers, Doctors, and Students, Research Policy Program, Lund, Sweden, 1967, 48 pp.

"This bibliography includes 415 items from 40 countries and regions of the globe on the migration of scientists. The latter are defined to include researchers, teachers, engineers, doctors, and students. The number of people engaged in these occupations will double within the next ten to fifteen years. The development of modern means of transport, the relaxation of political barriers and the professional need to travel will greatly increase the scale and the area of the mobility of scientists and their migrations". The bibliography is divided into sections on migration in general, history, studies and articles, news and comments, and advertisements. Entries are indexed by authors and countries and regions.

(The bibliography can be obtained from the Research Policy Program, Lund, Sweden).

14. "The Brain Drain Is Worse", New Scientist, v. 42, no. 644, 10 April 1969, p. 55.

"The brain drain from Britain is getting worse. The latest figures from the Ministry of Technology show that the net migration of scientifically qualified people reached 5000 in 1967, compared with 3600 in 1966. Most of the 5000 were

engineers and technologists (3600, representing 34 per cent of the new supply of manpower three years before). The 1400 scientists within the total, double the number in 1966, represented 14 per cent of the supply three years earlier. This method of computing the net flow is thought to give a more realistic picture than was adopted in displaying migration data in the Jones report on the brain drain, since quite a large proportion of the 'emigration' is in fact a circulation, particularly for school and university teachers and the younger people with science and engineering qualifications. The figures include for the first time teachers other than university teachers, doctors with some science degrees, other medical workers, and the managers who could not be identified before, using additional information gleaned from the 1966 census, so that they are higher than those in the report".

VIII SCIENCE POLICY IN FOREIGN COUNTRIES

International

38. Maru, R., "Research and Development in India and China: A Comparative Analysis of Research Statistics and Research Effort", Occasional Paper No. 1, Research Policy Program, Lund, Sweden, and Center for the Study of Developing Societies, Delhi, India, 10 April 1969, 71 pp.

The R&D statistics -- both official and estimates by individual scholars -- of China and India are critically reviewed and compared with respect to research expenditures and technical manpower. Some of the major conclusions of the study are as follows: The Chinese gross national expenditure on R&D in 1960 was about two and a half to six times the Indian expenditure, but in 1965 the gap was reduced to about one and a half to four times the Indian expenditure; China's R&D expenditures in terms of proportion of GNP for years 1958, 1960, and 1965 were 0.26, 0.69 and 1.28, respectively, as compared with 0.21, 0.25 and 0.45 for India during the same years; between 1950 and 1960, Chinese expenditures grew at two and a half times faster rate than the increase in Indian expenditures, but during 1960-65, the rate of growth has been slower than India's; China devotes 10 to 15 percent of expenditures to university research as compared with 6 to 11 percent for India; in 1965, Chinese scientific and technical manpower was over 254,000 or four times that of India, with 63,000 engaged in R&D versus 31,000 for India; between 1955-60 Chinese manpower increased by 370 percent as compared with 162.5 for India; and between 1960-65, China's rate of manpower increase doubled while India maintained the same rate.

(The report can be obtained from the Research Policy Program, University of Lund, Lund, Sweden).

39. "Programme for 1969/70", Science of Science Foundation Newsletter, v. 4, no. 2, February 1969, p. 8.

"In the field of natural sciences, Unesco's programme for 1969/70 centres on: science policy, scientific information and fundamental research; science education and technological training and research; and environmental sciences and research on natural resources. It is planned to organise in 1970 the first European conference of ministers concerned with science policy. In collaboration with the International Council of Scientific Unions (ICSU), Unesco will

continue its formulation of a world system for scientific information. Following the International Conference on the Biosphere, an inter-disciplinary programme is to be set up on 'Man and his Environment'. Unesco is to sponsor studies on the contribution that the social sciences can make to socio-economic planning and development. An international symposium will be held on this in 1970".

40. Schwartz, H., "Low-Key Confabs", Science News, v. 95, no. 8, 22 February 1969, p. 198.

The U.N.'s Economic Commission for Europe "is quietly pushing scientific and technological cooperation on the international level". "[T]he commission recently sponsored the first meeting of governmental science specialists from all ECE countries ... and laid plans for international cooperation on the problem of adopting new technology to local needs". First recommendation of the committee was a study of "criteria, institutions and policy for the effective application of science and technology in industry". The study would be carried out in conjunction with Unesco and would emphasize the "role of research in economic development". Other recommended projects include the following: a comparative study of national methods of technological planning, forecasting, systems analysis, and operational research applicable to economic goals; a register of existing governmental agreements on technology transfer, and analysis of results, problems and methods of implementation; studies of member countries' capacity to absorb new technologies; a study of national and international information systems; and "(c)operation in research in the field of management efficiency and operation research".

41. "The Promotion of Scientific Activity in Tropical Africa", Rpt. No. 11, United Nations Educational, Scientific and Cultural Organization (Unesco), Paris, France, 1969, 111 pp.

This document constitutes the Records of the Symposium on Science Policy and Research Administration in Africa, convened by Unesco in July 1967. The symposium was one of a number of regional meetings organized by Unesco as part of its program of aid to Member States in their science policy planning. The symposium's principal aims were as follows: (a) To evaluate the present situation regarding science policy and research organization (including science statistics) in the intertropical countries of Africa. (b) To analyze and forecast national science policy situations corresponding to geographical, political and economic realities in Africa. Taking these aims into consideration, four topics for discussion were proposed to the Symposium:

(i) Methodology for preparing science policy studies in the countries of Africa; (ii) Science planning and research programs in developing countries; (iii) Science statistics for Africa; (iv) Situation regarding science policy and research administration in African intertropical countries in the light of the Lagos recommendations.

(This report may be obtained from the Unesco Publications Center, 317 East 34th Street, New York, N. Y. 10016, Price \$2.00).

42. "Europeans Plan R&D Cooperation", Scientific Research, v. 4, no. 8, 14 April 1969, pp. 19,21.

The first proposals for Common Market cooperation in seven fields of R&D were agreed to by the European Economic Community's Aigain Committee. "The proposals do not contain directions for implementation, but observers say that the research cooperation will probably be carried out through existing intergovernmental arrangements, with only the loosest coordinating role for EEC". Among the proposed areas of R&D cooperation and specific programs are (1) "Data processing: establishment of a communications network between European research centers; creation of a European library of computer programs and a committee for standardization of software"; (2) "Telecommunications: research on the use of high frequency Hertzian waves and on the properties of semi-conductors"; (3) "Oceanography: pollution control and instrument development"; (4) Metallurgy: development of super-conducting components for physical research and of equipment for metallurgical research"; (5) "Toxicology" cooperation on the prevention of air pollution by sulfur compounds; research on car exhaust gases, noise, sewage purification, and thermal pollution"; (6) "Meteorology: creation of a joint meteorology: creation of a joint meteorological research center and subsequent development of European meteorological satellites".

43. "Gaps in Technology: Scientific Instruments", Organization for Economic Co-operation and Development, Paris, France, 1968, 178 pp.

This report is one of nine economic sector studies conducted by the OECD Committee for Science Policy for the "Third Ministerial Meeting on Science of OECD Countries", March, 1968. Its purpose was to assess the current state and role which Scientific Instruments play in the technological gaps between the member countries. Two major instrument groups are studied: "the 'off-line', or autonomous instruments and the 'on-line', or integrated instruments, which work in a continuous way and are linked to other instruments or computers". The main findings of the

report are organized around four topics: (1) Production and Markets, (2) Evaluation of National Disparities in Technical Performance, (3) R and D Innovation in Scientific Instruments, and (4) Differences in Management Policies and Attitudes. The report concludes that "there are no general and deeply-rooted disparities" between Member nations, but that differences do exist with respect to "successful produce innovation" and expansion of sales, with the U.S. leading in both areas. The possible causes of these differences are explored.

44. "Lagging Behind in Electronics", Nature, v. 221, no. 5187, 29 March 1969, pp. 1182-1183.

The OECD report, "Gaps in Technology-Electronic Components", is discussed. The writer draws these conclusions from the report: (1) "important innovations in the components industry have usually been developed by a small number of United States companies"; (2) American companies have little competition in granting licenses and selling "their know-how on the international market"; (3) American firms dominate several markets overseas"; and (4) American companies have a large and growing share of the export trade in components, particularly in the newer fields". Comparisons of percentages of GNP accounted for by electronics components in various nations suggest that the disparity may be a consequence of size of economy more than "intensity of effort deployed". Reasons for American dominance in the electronics field are cited: successful American marketing techniques, the direct connection between government agencies and industrial companies in the United States, lack of technological forecasting by European nations, and lack of mobility of European scientists and engineers. The OECD suggests that member nations be on "the look-out for ways of stimulating their electronics industries" since American methods are not applicable there.

45. Greenberg, D.S., "Uranium: Three European Nations Plan to Build Centrifuge Plants", Science, v. 164, no. 3875, 4 April 1969, pp. 53-55.

The intention of Britain, The Netherlands, and Germany to cooperate in building centrifuge plants for the production of enriched uranium is discussed. The U.S. gaseous diffusion plants have sufficient capacity, so "there has been no incentive for the U.S. to develop a centrifuge system". The Germans are reported "to have developed a centrifuge system on their own, but under the terms of the agreement, will forego having any of the plants on their own territory". The author feels that "the centrifuge agreement is unlikely to produce any short-term effects of military significance", but that "economic implications" may make it "one of the most important technological developments to take place in Europe for

a long time". Tentative plans are to build two plants, one at Copenhurst, England, and the other to "be near a major industrial chemical complex" in Holland. Planning "details remain to be worked out ... , and it is expected that one or both of the plants will be producing enriched uranium by 1973".

46. Samuelson, R.J., "Intelsat: Flying High, But Future Course Uncertain", Science, v. 164, no. 3875, 4 April 1969, pp. 56-57.

A month-long meeting of the International Telecommunications Satellite Consortium (Intelsat) failed to resolve some fundamental differences among members or to provide a permanent agreement on operations. Intelsat's 5-year history has been one of successful commercial operation, with the U.S. "theoretically" in control, since "more than half the investment was U.S. money". In actuality "Intelsat's government body almost always acted on unanimous -- or near unanimous -- recommendation". Comsat, the American representative has been the "manager"; however, "Europeans want an end to Comsat's role as 'manager' and reduction of the U.S. voting power". While "no one wants to jeopardize Intelsat's success by disrupting the practices of the last five years" (i.e., divest Comsat, an expert in its field, of all Intelsat work), the Europeans want to alter operations to allow more contributions from other Intelsat members. "The U.S. approach is to raise the banner of pragmatism. Intelsat has worked, so why tamper with a successful formula?" A working group will study the problems in the spring, and a full conference is expected to convene in November 1969 to debate the issues.

47. "Merging ESRO and ELDO?", New Scientist, v. 41, no. 642, 27 March 1969, p. 673.

A possible merger of ELDO and ESRO was raised again at a press conference in Munich: the intent of the merger would be to form a European "NASA" for better planning and use of limited funds. Professor Hermann Bondi, director of ESRO, "considers that, ideally, ESRO should aim at one large satellite project every two years ... backed up by several small satellites or high attitude rockets". To prevent any group from monopolizing the field, the "ideal industrial set-up would be three European consortia of firms spread over as many countries as possible", who would compete for ESRO contracts. ESRO satellites have a good record of success: three satellites are presently in orbit; one is under construction and planned for a 1972 launch. Possibilities for future studies are cited. Special studies are being made on a television satellite to serve Europe and

Africa. The project will cost about \$100 million and may take 5 or 6 years to complete. "Professor Bondi believes the main task of the European space organizations is to ensure that Europe is in a position to talk to the big space powers on more or less equal terms".

48. "European Space -- ESRO Euphoric", Nature, v. 222, no. 5188, 5 April 1969, pp. 4-5.

The European Space Research Organization (ESRO) approved three new satellites to be launched by 1972. In addition to a number of small satellites "now assured for the early 1970's, there is every possibility that by July Esro will be in a position to choose two major projects in the \$20-50 million class". The launching projects include the *Aurorae*, a second flight model (possibly October 1969) to study the northern aurorae; the HEOS A2, which will be put in a polar orbit late 1969 to map the polar magnetosphere; and the ESRO 4, to be launched in 1972, which will carry some of the experiments planned for the cancelled solar physics satellite. While ESRO is making some studies of applications satellites, "the organization is sensibly keeping off of the rather dubious bandwagon of earth resources satellites ... Instead it has its eye on applications where there are likely to be more financial benefits".

49. "Euratom Research -- Budget Trouble Again", Nature, v. 221, no. 5186, 22 March 1969, p. 1087.

The Euratom 1969 research budget was not adopted until early March (1969), and disagreements have developed since then. Member states have had to be allowed the option of pulling out of research projects. The budget is thus split into two parts: a compulsory joint program for all member states, and a supplementary program "in which states will pay only for the items in which they are interested". The current budget will carry Euratom only to the early part of July, "by which time the organization hopes to have ... agreed on a research programme covering several years". Euratom was forced to settle for 12-month budgets, principally because of France's disagreements with other member states. The research budget items in decreasing order of cost are heavy water reactors, fusion and plasma physics, plutonium and transplutonium elements, and fast reactors and high-temperature reactors. Most of the research projects are funded partly by the joint and partly by the supplementary program. "Negotiations have not yet begun for the budget spanning several years which must be established before July, but the end result is likely to be a cut in research funds".

50. "EMBO to Make Research Grants", Scientific Research, v. 4, no. 5, 3 March 1969, p. 16.

"One of the principal reasons for the creation of the European Molecular Biology Organization (EMBO) several years ago was to give European molecular biologists a chance to narrow the lead established over them by their U.S. counterparts. Last month EMBO took a long step toward the goal by converting itself from a private organization to a full-scale, government-funded body capable of making research grants. Just how much money EMBO will be able to raise for research grants from the governments of its 12 member nations, however, remains to be seen. This move is the second step in EMBO's evolution. The third, and most important, step remains only a hope. It will be the establishment of a European molecular biology laboratory complex like (and possibly at) CERN's Meyrin laboratory".

51. Greenberg, D.S., "NATO: Scientific Affairs Division a Miniature NSF for the Alliance", Science, v. 163, no. 3870, 28 February 1969, pp. 915-917.

The functions and activities of NATO's Scientific Affairs Division are discussed. The division's function has been compared to "a sort of miniature National Science Foundation for the 15-nation alliance". Although the division has an annual budget of only \$4.4 million, "it ranks high in the world as a source of support for postgraduate scientific training and scientific conferences". "In addition, it has a modest program of project support, and at present it is looking into new activities, with particular attention directed toward computer technology and oceanography. The postgraduate training program currently provides funds for more than 1000 scientists to train in universities and research institutes throughout the alliance". "The division also spends about \$700,000 a year to help support some 300 research projects in universities and research institutes of the member nations". "On a few occasions the Scientific Affairs Division has served as the spawning ground for proposals for new international activities in science and education. One of these proposals, which now seems to be on the brink of fruition after a good deal of uncertainty, is for a European Institute of Technology".

Australia

52. "Science, Technology and Society", Australian Journal of Science, v. 31, no. 31, December 1968, pp. 203-220.

This series of papers constitutes most of the contributions to a symposium organized by the Australian Academy of Science

and held on 3 May 1968. A foreword states: "In every industrial community, including Australia, the State is bound to play a larger and more positive role in determining the contribution of science and technology to economic and social development. National science policies which flow from this fact, demand more data and better criteria for action than has been the case in the past. These criteria can emerge from a fuller understanding of the relations between science, technology and society". The following papers were presented:

- Economic Appraisal of National Research and Development Problems -- B.R. Williams
- The Drift from Science to Arts -- J.B. Thornton
- Business in Today's Society -- K.W. Steel
- The Social Responsibility of Directors of Research -- J.E. Falk
- Summing Up -- S. Encel

Canada

53. Jackson, R.W., Henderson, D.W., and Leung, B., "Background Studies in Science Policy: Projections of R&D Manpower and Expenditure", Special Study No. 6, Prepared for The Science Council of Canada, 1969, 85 pp.

This report was prepared as background material for the Science Council Report No. 4, Towards a National Science Policy for Canada. Three studies comprise the report: "The Projected Supply of Scientists and Engineers in Canada", "The Inflation-Sophistication Factor", and "Gross Expenditures on R&D in Canada Projected to 1978". Some of the predictions of the report include: (1) gross expenditures on Canadian R&D will increase from the present \$800 million or 1.2 percent of GNP to around \$4 billion or 3.1 percent of GNP by 1978; (2) changes in the funding of R&D and in the proportion of R&D done by universities, industry and government are expected; (3) the number of scientists and engineers in Canada will increase from 113,000 in 1966 to 300,000 in 1978. The data collected in this study are intended to "provide a basis for the examination of the structure of the scientific market and analysis of its behavior and growth. Present and future estimations of the supply of scientific manpower and its capabilities must be accounted for in the "development of policy for science and research".

(This report may be obtained from the Queen's Printer and Controller of Stationery, Ottawa, Canada, Price \$1.25).

54. "Proceedings of the Special Committee on Science Policy", The Senate of Canada, First Session, Twenty-eighth Parliament, Nos. 32 and 33 (February 1969), Queen's Printer and Controller of Stationery, Ottawa, Canada, 1969.

These hearings are a continuation of the effort of the Canadian Senate to study Canada's science policy. The first of the two documents (No. 32) describes the activities, plans, and policies of the Canadian International Development Agency, the agency through which the Canadian government conducts its programs of assistance to the developing countries of the world. The second document (No. 33) presents testimony of the Central Mortgage and Housing Corporation (CMHC) regarding the role of R&D in housing and urban problems in Canada. CMHC's activities in this are described in an appendix.

China

55. Lindbeck, J.M., "An Isolationist Science Policy", Bulletin of the Atomic Scientists, v. 25, no. 2, February 1969, pp. 66-72.

China's exchanges and relationships with other nations in the areas of science, technology, and education are reviewed. China's priorities in these areas have remained the same for over a century: "First of all China wanted modern military technology, then science and, finally, education". The history of international contacts and exchanges are traced from 1860 up to the present; data are presented on the number of students and scholars involved, with special attention to China-Russia exchanges. The impact of the Cultural Revolution is described: over 300 students and researchers were recalled from Europe; over 100 Chinese scientific journals ceased publication; "institutions normally fostering and arranging foreign scientific relationships are in disarray and unable to function in this as in other respects". The current wave of anti-intellectualism, says the author, "is probably not meant to damage China's talented corps of first-rate scientists who can contribute to military and industrial development", but it "seems unlikely that these will be a change in the Chinese policy of restricting communications and exchanges before the Cultural Revolution comes to an end".

France

56. "Research and Development Figures", Science of Science Foundation Newsletter, v. 4, no. 2, February 1969, p. 3.

"According to a statistical survey recently published by the General Delegation for Scientific and Technical Research, 1,145 companies and 43 professional agencies stated that they had carried out research and development operations in 1966. Total cost of expenditure on research and development undertaken by these 1,188 companies was 5,850 million francs, an increase of 13.7 per cent compared with the 1965 figures. The expenditure representing 3.3 per cent of the total turnover of these companies was distributed as follows: aero-space industry, 30.3 per cent; electrical and electronic engineering (including data processing), 20.6 per cent; chemical, parachemical and pharmaceutical industries, 13 per cent; steel, non-ferrous metal, mechanical engineering industries, 10.5 per cent; energy and petroleum, 9.4 per cent; automobile industry, 7 per cent; miscellaneous industries (textile, building, food, paper industries), 9.2 per cent. 37.6 per cent of French industry's research and development costs are financed by the government (36.6 per cent in 1965). As in 1965, government contributions went principally to aero-space industries, 84.5 per cent of whose expenditures were financed by the government. The average cost per researcher increased from 240,000 francs in 1965 to 254,000 francs in 1966, which was a 5.9 per cent increase. The number of researchers and engineers employed in research and development activities in industry totalled 23,000 in 1966, which was a 5.5 per cent increase compared with 1965".

57. "What France Must Do to Catch Up", New Scientist, v. 41, no. 640, 13 March 1969, p. 553.

The principal recommendations of a government study group report on prospects for technical and scientific research in France for the next ten years are presented and discussed. These include: "Increase of the French [R&D] effort, to attain three-and-a-half per cent of the [GNP] by 1980 with development taking 60 to 75 per cent of this total; state R&D programmes to be geared to an overall industrial strategy and to be selected on a basis of their economic and social effectiveness; and the creation of a Technology Commission". "R&D in France over the next 10 years ... must be seen in the context of profound economic changes. The national economy will be integrated into the greater unity of the west European economy ... Scientific and technical research, therefore, will be an indispensable tool, 'but it is essential to travel all the way from invention to industrial and commercial exploitation'". "The report rejects the American notion

that Europe will never be able to rival the United States in key advanced industries such as aerospace, electronics and computers"; "indicates that French industry makes a comparatively high contribution to total research"; points out that state aid to industry is considerably lower than in the United States; and calls for larger industrial units.

58. "Science Policy and Organization of Research in the Federal Republic of Germany", Rpt. No. 12, United Nations Educational, Scientific and Cultural Organization (Unesco), Paris, France, 1969, 95 pp.

This is the twelfth study in the Unesco series "Science Policy Studies and Documents" initiated "to collect, analyze and disseminate information" concerning the science policy and organization of research of the Member States. The present study is divided into six parts. "Part One outlines the historical background of scientific development in the Federal Republic of Germany, and indicates the vicissitudes occasioned by political changes resulting from successive wars. Part Two describes the existing science policy structure and the organization of scientific and technological research. Part Three deals with the financing of scientific activities, including research. Part Four examines questions relating to scientific manpower, from the points of view of training, supply and demand, and career conditions. Part Five sets forth the principal aims of the country's national science policy. Part Six provides a concise sketch of the economic background to the country's scientific activities". Quantitative data regarding expenditure on scientific activities and details of numerous scientific organizations and projects are given in the tables and annexes.

(This may be obtained from the Unesco Publications Center, 317 East 34th Street, New York, N. Y. 10016, Price \$1.75).

59. Valéry, N., "The Re-birth of German Science", Science Journal, v. 5, no. 3, March 1969, pp. 82-87.

West Germany is now the largest spender on R&D in western Europe; £1250 million, or nearly 2.0 percent of its GNP, was spent for R&D in 1968. Germany's R&D effort has concentrated heavily on a few areas -- in particular atomic energy and aerospace. This article reviews the country's programs and accomplishments in these areas. The third nuclear energy program, running from 1968 to the end of 1972, has a provisional budget of £530 million, with about equal parts for basic research in high energy physics and for nuclear power development. Space research, which was started in 1962, has a planned expenditure of 190 million for the 1967-71 period, about 40 percent of which will go

to support whatever European space agency emerges from the planned fusion of ESRO, ELDO and CETS. The author believes that "German science, although excellent in many areas, remains an imported product" with too much emphasis "on copying what is being done in the United States".

Japan

60. Griffin, S., "Computers and the Gap", Science News, v. 95, no. 9, 1 March 1969, p. 222.

The status of Japan's five-year program for developing an independent computer capability is briefly reviewed. The prime goal of the program, which was initiated in 1966, is to develop a multipurpose system having a large memory with on-line and time-sharing capabilities. Complementing objectives include the development of an optical character reader (for letters, numbers, and Japanese ideographs), a voice input device, and a graphic display for some 250 ideographs including Chinese characters and Japanese syllabary. The program is sponsored by the government, coordinated by the Electrotechnical Laboratory, and implemented through a cooperative organization of government institutes, universities and industry. Despite some problems in obtaining consistent funding, "computer scientists are satisfied with the rate of progress to date, and predict completion of the program on schedule" in 1971. However, the Japanese "concede that the development of competent software capability will take a long time". At present, the Japanese "claims to be second only to the U.S. in the number of computers installed. But 40 percent of them are imported, and in the large sizes, the figure goes up to 65 percent".

61. "'Science City' A Political Stunt", New Scientist, v. 42, no. 644, 10 April 1969, p. 56.

"The Japanese government's ambitious plan to establish a 'Science City' ... is making little headway". Most Japanese view "the whole academic city concept ... merely as a political gesture toward a prefecture that has traditionally voted for the government party". The proposal calls for 36 institutions and other organs to move out of Tokyo. "They include Tokyo University of Education, the Industrial Science and Technology Agency, part of the Ministry of International Trade and Industry, a large part of the Tokyo Medical and Dental College, and sections of the Construction, Public Health and Welfare Ministries. Only two of the 36, however, have actually started building at their new sites in the Mt. Tsukuba foothills. The Japan Housing Corporation, which has been given the job of acquiring land, reports that the job is more than 80 percent

complete, despite lengthy and vigorous opposition from the farmers of the region". "There are two basic reasons for the opposition. One of them is money. Many people who are luke-warm about the 'Science City' point out that the Ministry of Finance has slashed several other departmental budgets". There is also great opposition from trade unions, which believe that workers' pay will not rise to make up for extra living costs involved in uprooting their families from Tokyo.

62. "Deadlock Delays Japan's 40 GeV Machine", New Scientist, v. 41, no. 640, 13 March 1969, p. 556.

Recent troubles hampering development of Japan's long-awaited 40 GeV proton synchrotron are discussed. The project dates back to 1962 at which time the Ministry of Education "acted originally on the basis of the Science Council recommendations to set up the basic research centre for elementary particles in five to six years, at a cost of \$83 million". However, arguments have recently developed among the authorities concerning how the institute should operate. "The physicists in industry ... balked at what they termed 'signs of massive government interference in advance'. They made clear that they would refuse to cooperate ... unless they were guaranteed complete freedom of research activities, such as is offered by other national institutes and universities in Japan". The Ministry refused to accept this, and "later added that it reserved the right to handpick the institute's director and vice-director"; the scientists contended "this contravened the Special Education Civil Service Law which governs the operation of all national universities and institutions". To add to the troubles, the Ministry of Finance has refused to furnish a supplementary budget of some \$4.5 million that had earlier been assumed as essential to get the project moving toward completion in 1969". Further funds cannot be authorized until the institute's operational formula is solved.

63. "Student Riots Upset Science in Japan", Scientific Research, v. 4, no. 31 March 1969, p. 17.

"Increasing student unrest in Japan is seriously disrupting the country's scientific research"; some of the issues related to the disruption are discussed. The students argue that "achievements in scientific research will only work to the advantage of the 'Establishment' and will not improve the lot of the ordinary Japanese. Like their counterparts in Europe, these students contend that scientific research will become meaningful only when the nation's socioeconomic system is changed so that the fruits of research benefit the people, instead of simply making the

rich richer". Students also complain about the lack of personal contact with professors; the "student population in Japan has doubled in the last eight years, to 1.2 million, and professors are frequently forced to lecture to mass audiences". "In addition, university scientists receive such low salaries [15-40 percent less than scientists in industry] and scanty research funds that they are forced to moonlight in order to support families and carry on their research".

India

64. Parthasarathi, A., "Appearance and Reality in Indian Science Policy", Nature, v. 221, no. 5184, 8 March 1969, pp. 909-911.

India's pioneering work in setting up a Government Department of Scientific Research to guide science policy decisions has been disappointing to the country's scientists. Twenty years of effort have not been effective in making policies for science a part of the overall political process. The problems have been manifold: the difficulties in establishing priorities between programs of various government agencies and the attendant budget difficulties; education and manpower allotments to various scientific areas of social concern, coupled with the loss of trained personnel to overseas opportunities; and a failure to solicit and consider participation of the scientific community. The author recommends that the government "create ... the conditions in which they can turn for advice on science policy matters generally to competent groups outside 'Government science'". In addition, the problem of social development "must inevitably lead to distribution and allocation receiving more attention, at least in the short run, than innovation".

65. Ghaswala, S.K., "Chaotic Congress", Science News, v. 95, no. 11, 15 March 1969, p. 270.

The annual Indian Science Congress, in its 56th year, has become too large, "has lost its scientific vigor", and discusses too many subjects. Outgoing president of The National Institute of Sciences of India, Prof. T.R. Seshadri "warned the Government against entrusting to any single scientist the privilege of advising it". Because many scientists "participating in the Government's decision-making machinery are taking responsibility they are not up to", he recommended "an independent advisory body of scientists". The results of the annual meeting are considered ineffectual "since the congress rarely has its advice taken by the Government either in scientific policy or in planning scientific research and

education". "While the structure and scope of the congress has increased during half a century, there is a general feeling that the meeting has reached its breaking point and tends to become chaotic and ineffective in its scientific output".

Poland

66. Malecki, I., "Development of Scientific Research in Poland, Nature, v. 221, no. 5181, 15 February 1969, pp. 622-623.

The development of scientific and technical facilities and associated policy in Poland is discussed. The author, a member of the Polish Academy of Sciences, describes the influences of historical events, from the 17th century to post-World War II, on this development. "With respect to the organization, financing and nature of scientific research", the author points out, "there are three principal groups of institutions: the universities, the institutes of the Polish Academy of Sciences, and the Government institutes, most of which are industrial". The rapid expansion in these three groups is detailed. In regard to financing of research, money comes from two major sources: the State Budget, which involves various ministries, and "Funds for Technical and Economic Progress", made up of "contributions from industry". "The general principle of Polish policy is to supply a 'thin' overall layer of resources and personnel to the scientific community" around certain focal points. Areas currently receiving particular consideration are: (1) "problems concerned with raising the standards of health and the environment"; (2) problems connected with food", (3) increasing the use of natural resources"; (4) "management of the national economy"; and (5) research for technical progress".

Switzerland

67. "Swiss Create a Department of Science", Scientific Research, v. 4, no. 7, 31 March 1969, p. 19.

"Switzerland has established a new federal Division of Science & Research to coordinate scientific and science education activities formerly handled by several different offices. The first task of the new division will be to administer the distribution to the country's universities of the federal funds voted last year. Approximately \$270 million, a very large sum in Swiss terms, will be allocated to universities over a period of six years, beginning this year, for equipment and general upgrading. More than half the sum is earmarked for specific

projects, such as physics labs and other research facilities, libraries, auditoriums, and programs of inter-university cooperation. The balance will go directly to the cantons to use at their discretion. "Other activities of the division will be: examination of basic questions of scientific and university policy; coordinating work in the fields of science and science education, with emphasis on the encouragement of young scientists, documentation of research at home and abroad; and, with other relevant departments in the federal administration, representing Switzerland's scientific interests at the international level".

United Kingdom

68. "Research Expenditure -- Government More Bountiful", Nature, v. 221, no. 5183, 1 March 1969, p. 790.

The annual Vote of Account presented by the Chancellor of the Exchequer to the House of Commons provided increases "at comparatively generous rates" for the research councils. The percent increase rates for the 1969-70 period over the 1968-69 period ranged from 8.82 percent (\$45.844 million) for the Science Research Council to 37.7 percent (\$2.38 million) for the Social Science Research Council. The Ministry of Technology and Department of Education showed declines in their budgets. The Vote of Account document is "intended to bridge government financing operations from one year to the next". "The British Government has managed to keep public spending more or less within the targets it set itself. Total expenditure for 1969-70 shows only a modest increase in real terms, which come as something of a relief to the foreign exchange markets, which had feared a repetition of last year's run on the pound after the publication of the Vote of Account".

69. Hill, R.B., "The Improvement of Returns from Research and Development Investment", Advancement of Science, v. 25, no. 125, March 1969, pp. 269-278.

The management, resources and organization of R&D in the UK are examined and suggestions are made for improvement. Starting from a description of the major types of R&D laboratories and their objectives, the author surveys UK's research resources, and discusses how industrial R&D can be improved through new policies for research expenditures, manpower, and organization. Although the author believes that UK's total R&D expenditure "is probably correct", he calls for a larger proportion of resources for industrial research and less for academic and government labs. He also proposes less effort on defense R&D; more efficient use of technical manpower

through closer links between "research workers and the users of the research"; more industrial scientists; upgrading the salary and status of engineers and scientists; and the setting of "targets for research achievements" by management.

70. "Programme for Select Committee", Nature, v. 221, no. 5186, 22 March 1969, p. 1086.

"For the first time, the British research councils are to come under regular parliamentary scrutiny. The Select Committee on Science and Technology of the House of Commons has decided to start by investigating the Natural Environment Research Council, and it is likely that the examination of one of the research councils will become an annual event. The first investigation will be carried out by a sub-committee, while another sub-committee intends to spend the next few months following up the work already done on the reorganization of the nuclear power industry in Britain. The Select Committee seems to be far from happy with the way the industry has been reorganized, and it is clear by now that the Government is not following the advice the Select Committee gave in its first report on the subject a year ago". "Both these investigations seem well timed". "Recently the unhelpful 'policy statements' at the Oceanology Exhibition at Brighton and the formation of an interdepartmental advisory committee have encouraged people to ask what the Government's policy is, but no satisfactory answer has yet been forthcoming. The committee's report on British defence research should emerge within the next six weeks or so".

71. Clarke, R., "How the 300 GeV Decision Was Made", Science Journal, v. 5, no. 3, March 1969, pp. 4-5,7.

In June of 1968, Britain officially announced its decision not to participate in CERN's plan to build a 300 GeV proton accelerator. Since then, much has been written about the "alleged folly of the decision", but little has been said in public of the machinations that led to the decision or of the events that followed it". The story of the episode, starting from 1965, is traced in this article. The major studies undertaken to consider the question are reviewed, and the views and roles of scientists and the Cabinet are described. "What now emerges is that the procedures by which scientists offer advice, and the basis on which major scientific decisions are made, need close examination. And most of all, if any semblance of a democratic process is to be seen to occur in such decisions, some substantial changes should be instituted. As it is, the most major decision in science in the UK since World War 2 was taken on unpublished advice which differed from that offered and published by the recognized authorities".

72. Clarke, R., "Sponsored Research and Universities", Science Journal, v. 5, no. 1, January 1969, pp. 81-86.

The characteristics, trends, and policies of sponsored research in US and UK universities are discussed. American universities receive about 13 percent of total federal R&D funds, as compared with 61 percent for industry, and 20 percent for government laboratories. Some UK university sponsors have deeply involved American universities in national defense and recent anti-war demonstrations illustrate dissatisfaction with this policy. Although British universities also receive most of their funds from government, they do so through the University Grants Committee (UGC) which acts as a "buffer" between the universities and government, providing British universities with more autonomy than is enjoyed by American institutions. Other British government research money comes mainly from the Ministry of Technology and the Ministry of Defence. The trend towards sponsored research in Britain is increasing with accompanying problems: (1) autonomy is threatened as universities become more dependent on sponsors; (2) free publication is compromised; (3) the UGC is "beginning to indicate to universities the preferred priorities" in money spending; and (4) there is no concrete policy on what kind of research a university should undertake. The author recommends that universities form "a working group to try and sort out some general principles for future guidance".

U.S.S.R.

73. "Science Policy in the USSR", OECD Observer, no. 38, February 1969, pp. 10-14.

The Organization for Economic Co-operation and Development (OECD) has completed a massive study of Russian science policy. The study, which runs to 750 pages, focuses on five main topics: Central Planning of R&D, Scientific and Engineering Manpower Resources, Organization and Planning of R&D in the Higher Educational Establishments, Organization and Planning of R&D in the Academy System, and Science and Industry in the USSR. The present article summarizes some of the major findings of the OECD study: highest priority has been given to defense, space, and atomic energy research, with much less emphasis on the chemical, computing, transportation, and consumer products areas; the lag in the latter areas "is due to the relative paucity of resources", the "inadequacy of development ... and the weakness in application of research results to new industrial products and processes"; factors contributing to the relatively weak development and application of research are the "orientation of economic planning towards

achievement of maximum production" and "organisational barriers between different phases of the research-production cycle"; resources devoted to research are greater than those going to development (a reversal of the US pattern); the number of graduate scientists and engineers in R&D is 475,000 to 650,000 (substantially larger than for the US); R&D expenditure is estimated as \$15 to 12 billion a year.

74. Kozlowski, J.P., "R&D in the U.S.S.R.", Science & Technology, no. 87, March 1969, pp. 10-19.

This report on the OECD study of science policy in the USSR (see above), prepared by one of the authors of that study, discusses the problems of the Russian R&D system, the reforms underway and prospects for the future. Before discussing the problem, the author points out that the USSR spent more money for R&D in 1968 than the US (\$25.8 billion vs. \$25.0); this was the first year that the US had spent less. A prime problem, says the author, is that resources are over committed for research and under-committed for development. Other problems include "the excessive migration of engineers" from industrial research to scientific research institutes; poor facilities and equipment for applied research; the small role of higher education in applied research; a system of accounting and financing that rewards by volume of work; and duplication of effort. "Soviet planners clearly realize the causes behind all existing problems ... reforms of a major nature are at hand". These, started in 1966, involve "competition, institution of a quasi-profit system, and radical upgrading of wages and incentives for scientists and engineers". R&D priorities are beginning to shift, with less effort on space, and more on the life sciences and social sciences. Other expected changes -- in planning, organization, and priorities -- are cited.

[Other reviews of the OECD report on Science Policy in the USSR can be found in:

Scientific Research, v. 4, no. 1, 6 January 1969, p. 13.

Nature, v. 221, no. 5178, 25 January 1969, pp. 307-308.

New Scientist, v. 41, no. 636, 20 February 1969, pp. 409-412.

Science, v. 163, no. 3870, 28 February 1969, pp. 917-918].

75. "Russians Initiate Research Payoff", Scientific Research, v. 4, no. 7, 31 March 1969, p. 21.

Plans to implement the new Russian policy calling for more applied and less basic research, and more payoff for investment in R&D are presented. "The main points of the new policy are: financing will be by specific project, rather than by institute; and pilot research institutes will be designated for specified project categories and will have ultimate responsibility for and financial control over all developments in that category, whether the research is actually carried out in the pilot institute or in another institute. The Electrical Ministry's research operations will be carried out by three types of organizations: large pilot institutes; small, highly specialized institutes that will do work in their field on commission from other institutes; and institutes integrated within industrial plants". "All orders for research work must include an evaluation of similar products in existence". "A rating system for all products manufactured by the Ministry will be set up ... Institutes themselves will also be rated on two grounds: the technical quality of the work produced, and the economic savings generated. A system of payment to institutes on the basis of results produced will also be established. The objective is to make research institutions self-supporting and to free them from the fear of not spending all the funds allotted them through state grants".

76. "USSR r&d Gets Incentive Bonuses", Scientific Research, v. 4, no. 8, 14 April 1969, p. 19.

"Incentive pay for scientists is being introduced as a step in the overhaul of the Soviet r&d establishment. The Karpov Chemical Research Institute here has just adopted a system of sliding-scale salaries and bonuses for its scientific staff that relates the scientists' incomes to their research performance. This move is the first implementation of last fall's decree that individual scientists will henceforth be evaluated periodically and that their incomes will be tied to the evaluations". "The system has two principal elements: elimination of an advanced degree as a salary determinant; and a base salary for all workers to which a bonus of as much as two-thirds of the base pay can be added, depending on the evaluation of individual work performance. Evaluations begin with a report by lab directors and are then reviewed by two ad hoc committees of distinguished scientists. The first evaluation of the 500 workers at the Karpov Institute resulted in salary cuts for 14 percent of them, including three senior lab directors, and raises for 18 percent".